THE MAGAZINE OF METAL COMPONENT DESIGN AND PRODUCTION

NOVEMBER 1981

# Precision Metal

A Penton/IPC Publication

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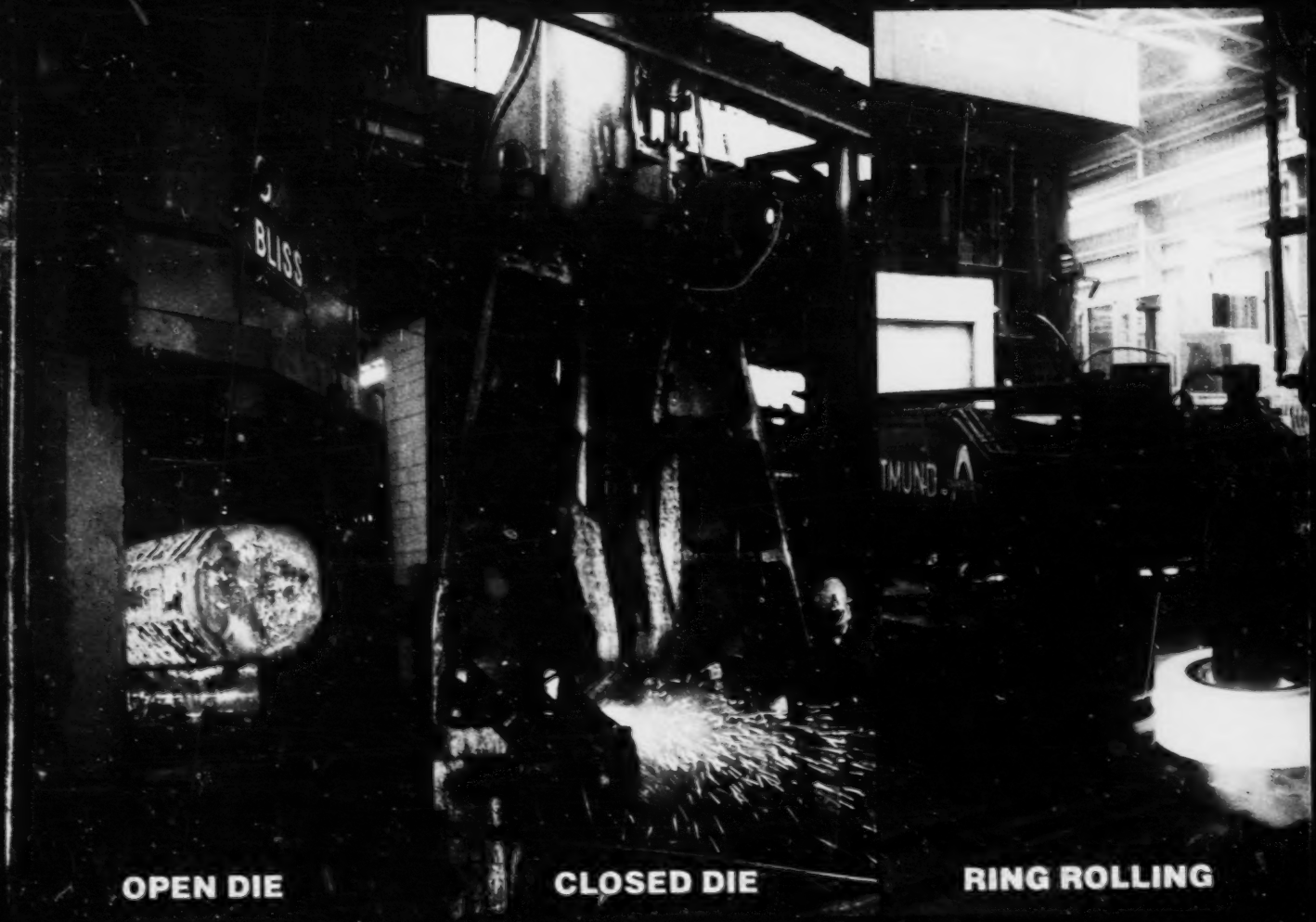
What U.S. forgers can do for you and how they can do it




OPEN DIE

CLOSED DIE

RING ROLLING

## 1981 State of the Industry Report

Shipments, installed equipment, plans to buy and a glimpse into the future of the die casting, extrusion, forging, investment casting, powder metallurgy, stamping and roll forming industries.

November 1981
Volume 39
No. 11

# Precision Metal

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ABOUT THE COVER

Product designers can benefit from the diversity of the forging industry if they know how to use it. Our thanks to these companies for supplying the cover photos: open die forging, McInnes Steel Co.; closed die forging, Pittsburgh Forgings Co.; ring rolling, Rotek Inc.

# STATE OF THE 1981 INDUSTRY

By JAMES E. BILLINGSLEY, associate editor

The precision metal industries are faced with many challenges as they move through the 1980's. Increased energy and materials costs, an uncertain economy and the specter of foreign competition are just some of these. This report is intended to help management and production executives in the precision metal industries prepare for these challenges by giving them a picture of their industries at this time.

Over the quarter-century following the end of World War II, the precision metal industries showed steady growth sometimes exceeding that of the economy as a whole. Since 1970, however, metal part production has been erratic, with shipments dropping sharply in recessions and increasing sharply in recoveries—perhaps a symptom of these industries' heavy dependence on specific markets, most notably the automobile, aerospace and building construction industries. Finding applications in new markets is another challenge for some of the precision metal industries in the coming decade.

Most of the information in this report was obtained through a survey conducted by Penton/IPC Marketing Research & Economic Analysis for PRECISION METAL during April, May, and June, 1981. Questionnaires were sent to management and production executives chosen from our circulation list in the industries covered by PRECISION METAL. Wherever appropriate, data from other sources was included to give a fuller picture.

The respondents' output chart gives total industry custom & captive percentages. These were obtained by taking the "custom & captive" category from the "respondents to our survey were" chart, adding up the fractions of their output that were custom and were captive, and adding these totals to the numbers of purely custom and purely captive respondents. Custom and captive output percentages were then derived from these numbers.

The geographic distributions indicate the percentage of plants producing or using precision metal parts in the regions shown on the maps. The relative height of a region is proportional to the relative concentration of an industry's producers or users in that region.

Plant size breakdowns give the percentages of plants that fall into the given size categories, either by number of employees or by shipment volume.

The "Number of plants" column for capital equipment indicates the number of responding plants which have a given piece of equipment installed in the listed size range (for example, 61 responding plants had hot chamber die casting machines installed with capacities of under 100 tons). The number given for "Total" indicates the number of plants with the given piece of equipment, not the total of the column above it (thus, the "Number of plants total" for hot chamber die casting machines is 122, not 239).

The "Number of machines" column indicates the number of machines our respondents have in each size category. Plant averages were computed using the number of plants indicated on the "Based on" line, not on the number of plants having machines in a given size category.

Industry totals for installed capital equipment in all industries were projected by assuming a total number of plants in an industry, dividing this number by the number of plants that answered the appropriate question, and multiplying this ratio by our respondents' totals. As an example, we assumed an industry total of 800 plants for die casting, 165 plants answered the question on die casting machines,

*continued*

# STATE OF THE INDUSTRY *continued*

and our respondents had a total of 820 hot chamber machines. A quick computation with a calculator reveals a projection of roughly 3976 hot chamber machines. This number was rounded off to 4000 because of the errors inherent in projecting industry totals from data gathered from a fraction of the industry. All projections were rounded off to no more than two significant figures. Projected totals less than 100 were rounded to the nearest ten because it was felt that these projections were likely to have a larger percentage error than other projections. Note that projections for machine sizes may not add up to the total projection due to rounding.

The plant totals on which the projections were based were estimated from our knowledge of the precision metal industries, confirmed with outside sources in some cases.

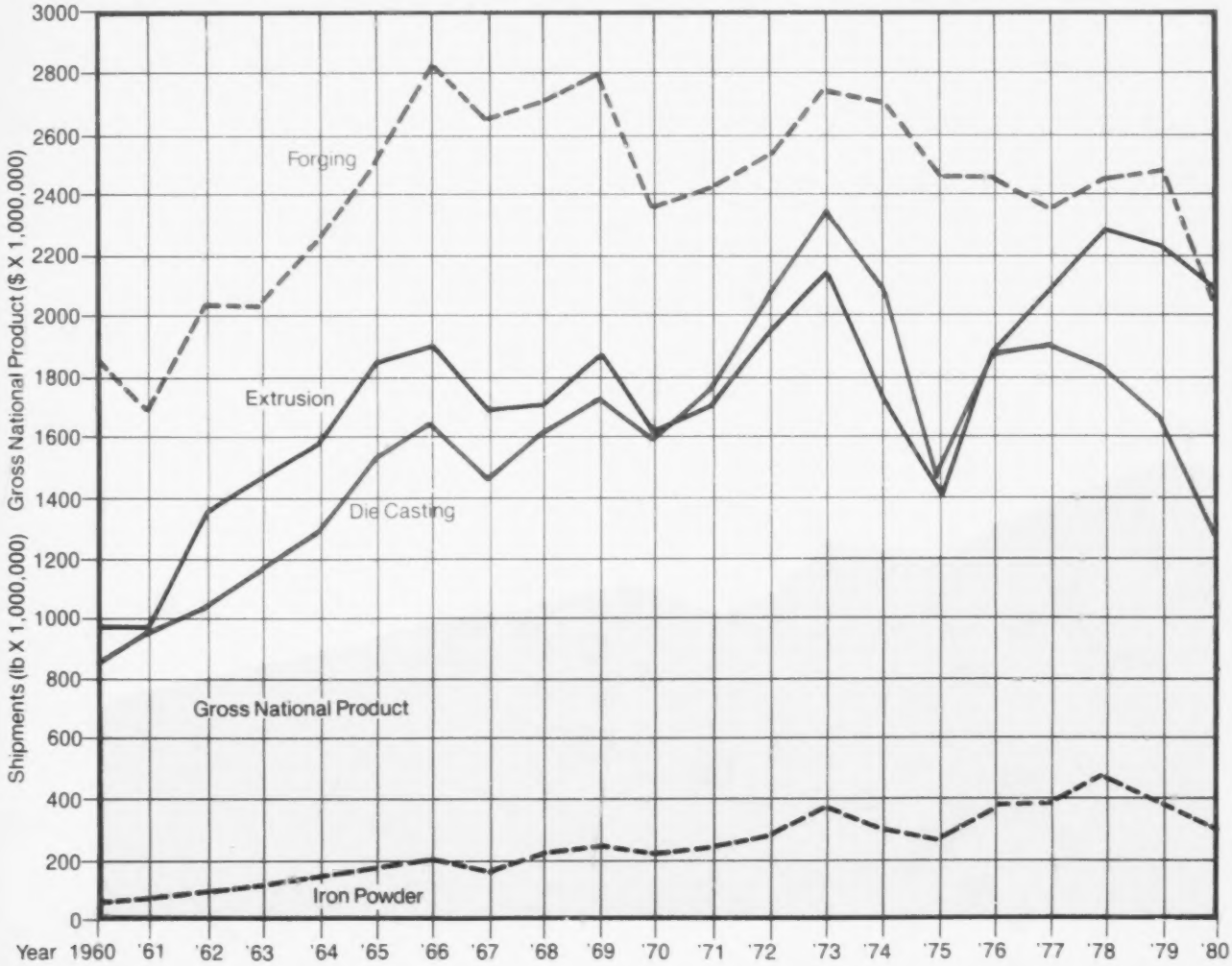
No projections were made for buying plans. The number of plants planning to buy machines in a given size category are given along with the number of machines they plan to buy.

It was assumed that all responses for capital equipment were complete. Thus, for example, if the question on cold headers in the forging questionnaire was left blank, it was assumed that no cold headers were installed in that plant.

Expendable supplies projections were prepared like capital equipment projections, except for die casting, extrusion and forging. The methods used in these industries are explained in their reports.

The industry surveys were supervised by Robert Schenk, director, Penton/IPC Marketing Research & Economic Analysis. Barbara Ramonis, Penton/IPC artist, was responsible for the design and production of the section.

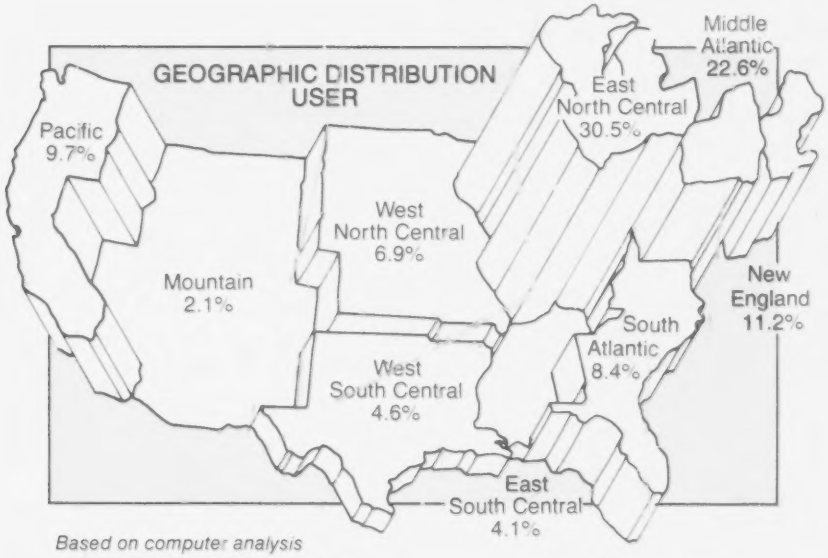
TRENDS IN METAL PART PRODUCTION WITH RESPECT TO GROSS NATIONAL PRODUCT



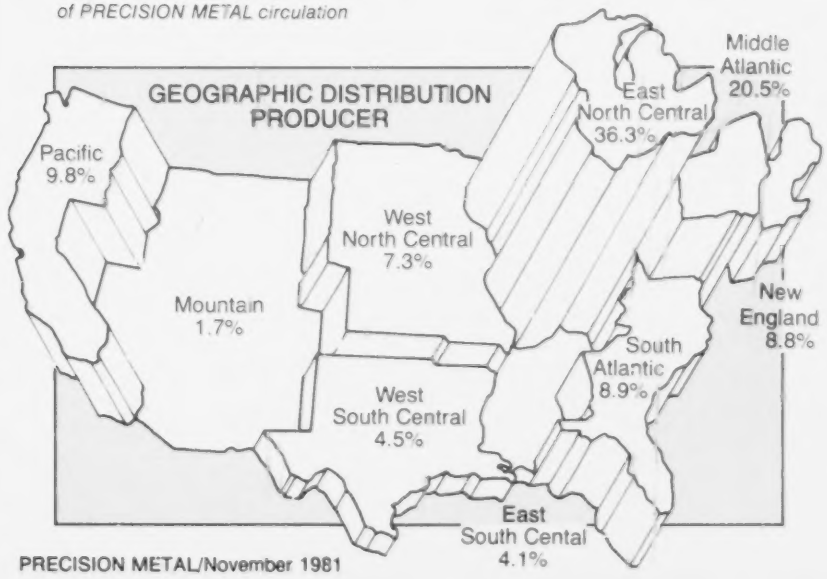
# STATE OF THE DIE CASTING INDUSTRY

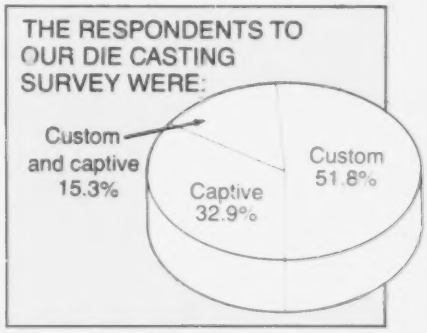
Questionnaires were sent to 1260 management and production executives in the die casting industry. A total of 174 useful responses were received for a response rate of 13.5%. An industry total of 800 plants was assumed for the purpose of projecting industry totals.

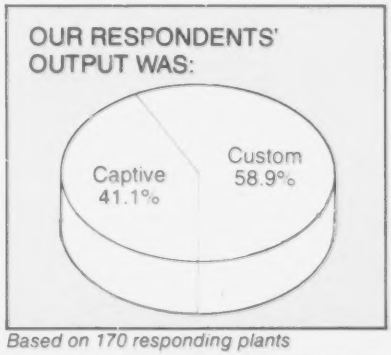
The die casting industry had a relatively difficult year in 1980. The largest user of die castings, the automobile industry, had a very poor year (all of the Big Three lost money), which had much to do with the die casting industry's problems. Die casting poundage was affected not only by the low level of auto sales, but also by increased import penetration and the trend toward smaller cars, which often use fewer and smaller die castings. The decline in zinc poundage is somewhat misleading, however, due to the increased usage of thin wall die castings, which weigh substantially less than the castings they replace. Although 1981 seems to be a somewhat better year for the automobile industry, high interest rates continue to cloud the industry's future. One



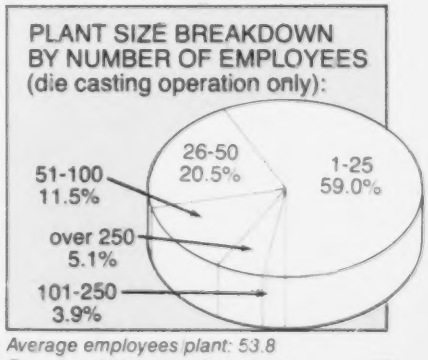

*Based on computer analysis of PRECISION METAL circulation*




*Based on 170 responding plants*




*Average employees plant: 53.8*
*Based on 156 responding plants*

bright note is that the average age of cars on the road has increased in recent years, meaning that many purchases have been deferred, holding the possibility of a sales boom when economic conditions improve.

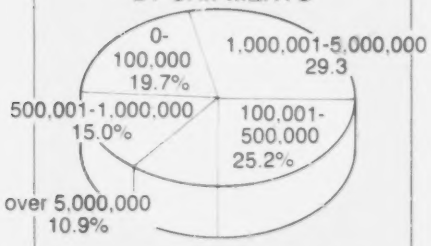
The sluggish economy affected die casting's other markets in 1980. Most of the other market segments covered in the Zinc Institute survey were off slightly compared to 1979, which was itself a sluggish year in some industries. Aluminum shipments also suffered in 1980 after holding up well throughout the 1970's. Magnesium shipments, which had nosedived following the magnesium price rise in the mid-1970's, slid back again after having recovered somewhat. This metal would seem to have a bright future, considering the continuing push for automtoive weight reduction. Die casting industry prospects will improve when the overall state of the economy improves.

Aluminum shipments continue to be primarily captive, while those of zinc continue to be primarily custom. The majority of operations are relatively small, employing 25 or fewer people. The industry is most heavily concentrated in the East North Central (Great Lakes) region.

Rebuilding has become popular as a means of getting a longer lifetime out of an installed die casting machine. Our respondents plan to rebuild 70% more machines than they plan to buy by the end of 1982. Installed capacity in die casting isn't as old as it is in some other industries—the largest number of installed die casting machines fall into the 6-10 and 11-15 year old classes. Buying plans are concentrated in the size ranges that have the most machines already installed.

Furnaces used in the industry are largely still fuel-fired, although there seems to be a trend toward electric holding furnaces. There is a definite increase in the use of material handling equipment, particularly robots. Our respondents plan to buy one-third as many robots as they presently have installed. The usage of instrumentation

PLANT SIZE BREAKDOWN BY SHIPMENTS




*Based upon 147 responding plants*

DIE CASTING SHIPMENTS 1971-80: AMERICAN DIE CASTING INSTITUTE

| Metal | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Aluminum** | | | | | | | | | | |
| Custom | 480 | 544 | 620 | 538 | 350 | 420 | 480 | 540 | 610 | 530 |
| Captive | 560 | 652 | 708 | 552 | 530 | 780 | 840 | 890 | 930 | 904 |
| Total | 1040 | 1196 | 1328 | 1090 | 880 | 1200 | 1320 | 1430 | 1540 | 1434 |
| **Zinc** | | | | | | | | | | |
| Custom | 540 | 636 | 712 | 484 | 426 | 490 | 526 | 532 | 550 | 390 |
| Captive | 464 | 504 | 532 | 396 | 254 | 340 | 314 | 300 | 270 | 238 |
| Total | 1004 | 1140 | 1244 | 880 | 680 | 830 | 840 | 832 | 820 | 628 |
| **Magnesium** | 17.5 | 21.5 | 25.5 | 26.5 | 17.0 | 12.7 | 11.0 | 13.0 | 14.0 | 12.9 |
| **Other** | 64.1 | 69.1 | 64.2 | 56.4 | 46.8 | 41.3 | 38.6 | 38.5 | 39.0 | 26.9 |

*Amounts are in millions of pounds.*

DIE CASTING SHIPMENT TRENDS

| Metal or alloy | 1981 change (%) | 1982 Expectation (%) | | |
|---|---|---|---|---|
| | | Increase | Decrease | About the same |
| **Zinc** | +4.4 | 56.2 | 10.5 | 33.3 |
| **Aluminum** | −20.6 | 66.3 | 5.6 | 28.1 |
| **Magnesium** | −17.7 | 100.0 | 0.0 | 0.0 |
| **Brass** | +14.2 | 25.0 | 0.0 | 75.0 |
| **Lead** | +31.9 | 66.7 | 0.0 | 33.3 |
| **Copper** | 0.0 | 0.0 | 0.0 | 100.0 |

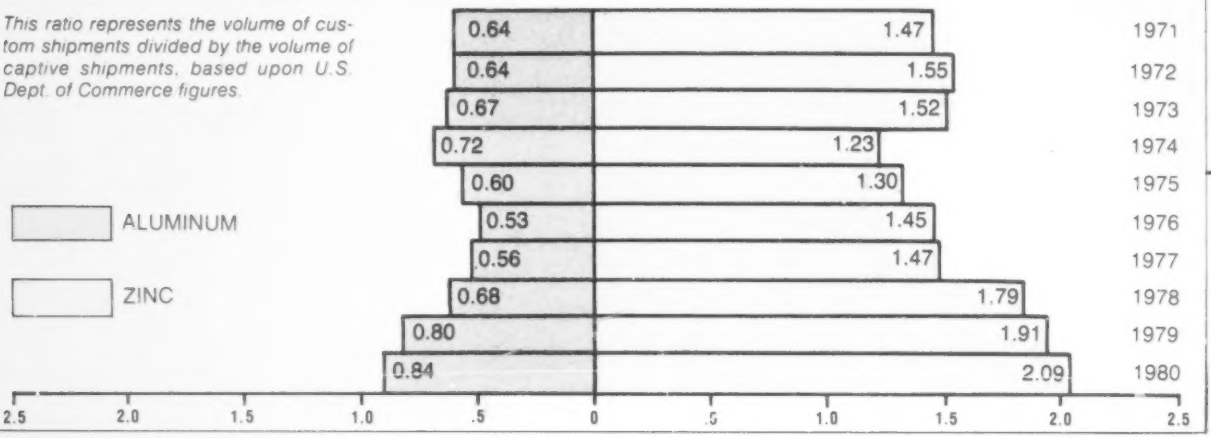
*The 1981 change column represents respondents' expected change in shipment poundage from 1980, expressed in percent.*

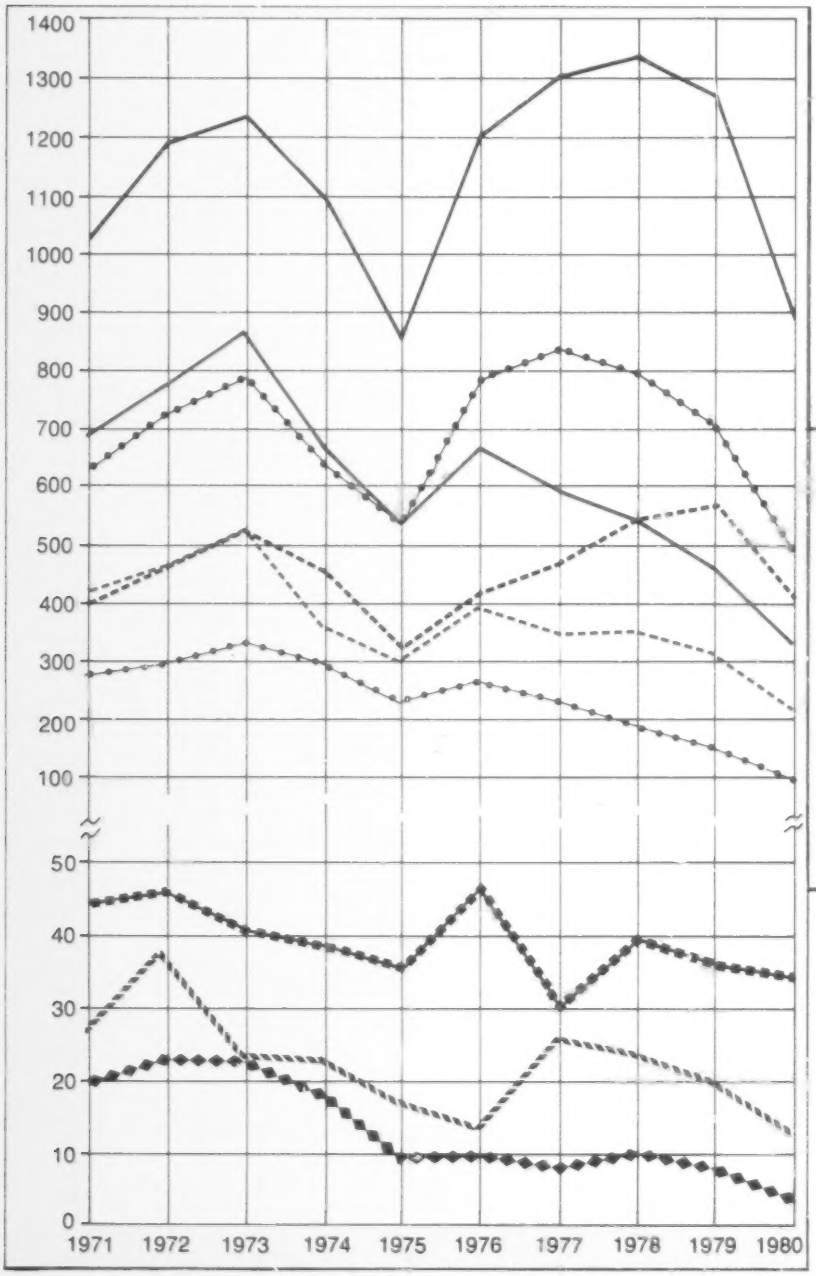
*The 1982 expectation columns give the percentage of respondents expecting 1982 shipments to increase, decrease or stay about the same as 1981.*

*Based upon 147 responding plants*

## CUSTOM/CAPTIVE RATIO, ALUMINUM & ZINC, 1971-80

*This ratio represents the volume of custom shipments divided by the volume of captive shipments, based upon U.S. Dept. of Commerce figures.*




DIE CASTING SHIPMENTS 1971-80:
U.S. DEPT. OF COMMERCE

**Aluminum**
- Custom
- Captive
- Total

**Zinc**
- Custom
- Captive
- Total

- **Copper-base**
- **Lead**
- **Magnesium**

*Amounts are given in millions of pounds. Note: Magnesium figures include permanent mold & other castings*

## DIE CASTING *continued*

| HOT CHAMBER DIE CASTING MACHINES — INSTALLED | | | | |
|---|---|---|---|---|
| Size in tons (locking force) | Number of plants | Number of machines | Average/ plant | Project ind. total |
| Under 100 | 61 | 266 | 1.6 | 1300 |
| 101-250 | 67 | 227 | 1.4 | 1100 |
| 251-400 | 56 | 170 | 1.0 | 820 |
| 401-550 | 27 | 88 | 0.5 | 430 |
| 551-700 | 17 | 42 | 0.3 | 200 |
| 701-850 | 9 | 21 | 0.1 | 100 |
| 851-1000 | 1 | 2 | 0.0 | 10 |
| over 1000 | 1 | 4 | 0.0 | 20 |
| Total | 122 | 820 | 5.0 | 4000 |

*Based on 165 responding plants*

| COLD CHAMBER DIE CASTING MACHINES — INSTALLED | | | | |
|---|---|---|---|---|
| Size in tons (locking force) | Number of plants | Number of machines | Average/ plant | Projected ind. total |
| Under 100 | 11 | 43 | 0.3 | 210 |
| 101-250 | 21 | 40 | 0.2 | 190 |
| 251-400 | 37 | 97 | 0.6 | 470 |
| 401-550 | 48 | 204 | 1.2 | 990 |
| 551-700 | 57 | 265 | 1.6 | 1300 |
| 701-850 | 26 | 57 | 0.3 | 280 |
| 851-1000 | 14 | 55 | 0.3 | 270 |
| over 1000 | 8 | 73 | 0.4 | 350 |
| Total | 88 | 834 | 5.0 | 4000 |

*Based on 165 responding plants*

| HOT CHAMBER BUYING AND REBUILDING PLANS | | | | |
|---|---|---|---|---|
| | Plan to buy by end 1982 | | Plan to rebuild by end 1982 | |
| Size in tons (locking force) | Number of plants | Number of machines | Number of plants | Number of machines |
| Under 100 | 15 | 33 | 15 | 44 |
| 101-250 | 9 | 11 | 17 | 31 |
| 251-400 | 11 | 12 | 16 | 24 |
| 401-550 | 3 | 5 | 9 | 12 |
| 551-700 | 2 | 2 | 5 | 6 |
| 701-850 | 0 | 0 | 0 | 0 |
| 851-1000 | 0 | 0 | 0 | 0 |
| over 1000 | 0 | 0 | 0 | 0 |
| Total | 33 | 63 | 49 | 117 |

*Based on 165 responding plants*

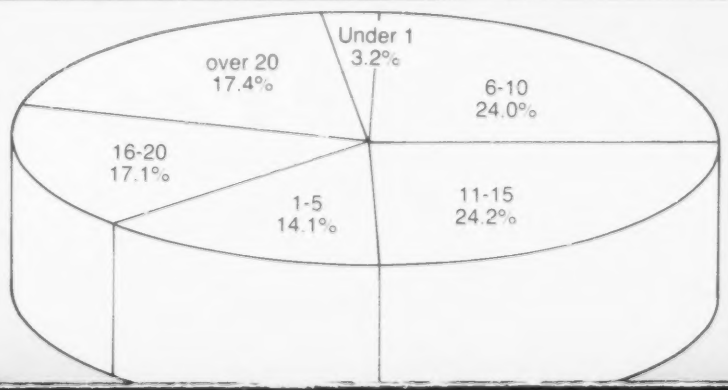
| COLD CHAMBER BUYING AND REBUILDING PLANS | | | | |
|---|---|---|---|---|
| | Plan to buy by end 1982 | | Plan to rebuild by end 1982 | |
| Size in tons (locking force) | Number of plants | Number of machines | Number of plants | Number of machines |
| Under 100 | 2 | 2 | 2 | 5 |
| 101-250 | 3 | 5 | 3 | 3 |
| 251-400 | 6 | 9 | 11 | 16 |
| 401-550 | 13 | 19 | 14 | 25 |
| 551-700 | 16 | 20 | 19 | 37 |
| 701-850 | 8 | 8 | 4 | 8 |
| 851-1000 | 2 | 2 | 2 | 7 |
| over 1000 | 2 | 2 | 0 | 0 |
| Total | 41 | 67 | 37 | 101 |

*Based on 165 responding plants*

### DIE CASTING MACHINE BREAKDOWN BY AGE

***Based on 166 responding plants***

***84 of 162 responding plants had 170 machines rebuilt last year.***



## FURNACES

| Type | Now have installed: Number of plants | Number of furnaces | Average/ plant | Projected ind. total | Plan to buy by end 1982: Number of plants | Number of furnaces |
|---|---|---|---|---|---|---|
| **Breakdown** | | | | | | |
| Fuel-fired | 122 | 387 | 2.3 | 1900 | 25 | 36 |
| Electric | 29 | 153 | 0.9 | 740 | 10 | 16 |
| **Holding** | | | | | | |
| Fuel-fired | 79 | 512 | 3.1 | 2500 | 11 | 28 |
| Electric | 32 | 309 | 1.9 | 1500 | 14 | 29 |

*Based on 165 responding plants*

## MATERIAL HANDLING EQUIPMENT

| Type | Now have installed: Number of plants | Number of machines | Average/ plant | Projected ind. total | Plan to buy by end 1982: Number of plants | Number of machines |
|---|---|---|---|---|---|---|
| Casting conveyors | 66 | 268 | 1.6 | 1300 | 19 | 44 |
| Scrap conveyors | 59 | 185 | 1.1 | 900 | 13 | 19 |
| Robots | 33 | 162 | 1.0 | 790 | 22 | 54 |
| Extractors | 25 | 106 | 0.6 | 510 | 10 | 13 |

*Based on 165 responding plants*

## DIE MAKING EQUIPMENT

| Type | Now have installed: Number of plants | Number of machines | Average/ plant | Projected ind. total | Plan to buy by end 1982: Number of plants | Number of machines |
|---|---|---|---|---|---|---|
| Duplicators | 31 | 58 | 0.4 | 280 | 2 | 2 |
| EDM machines | 56 | 86 | 0.5 | 420 | 10 | 10 |
| N/C equipment | 13 | 37 | 0.2 | 180 | 7 | 9 |

*Based on 165 responding plants*

## Finishing equipment

| Type | Now have installed: Number of plants | Number of machines | Average/ plant | Projected ind. total | Plan to buy by end 1982: Number of plants | Number of machines |
|---|---|---|---|---|---|---|
| Vibratory/barrel | 117 | 317 | 1.9 | 1500 | 21 | 29 |
| Polishing/buffing | 47 | 322 | 2.0 | 1600 | 6 | 25 |
| Paint spray | 44 | 88 | 0.5 | 430 | 5 | 5 |
| Plating | 27 | 48 | 0.3 | 230 | 4 | 7 |

*Based on 165 responding plants*

## TRIM PRESSES

| Type | Now have installed: Number of plants | Number of machines | Average/ plant | Projected ind. total | Plan to buy by end 1982: Number of plants | Number of machines |
|---|---|---|---|---|---|---|
| Mechanical | 85 | 579 | 3.5 | 2800 | 6 | 14 |
| Hydraulic | 113 | 927 | 5.6 | 4500 | 34 | 65 |

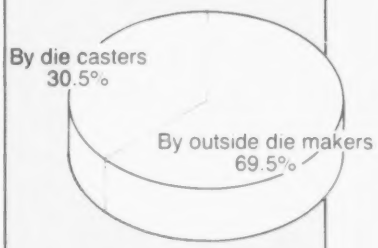
*Based on 165 responding plants*

## OTHER CAPITAL EQUIPMENT

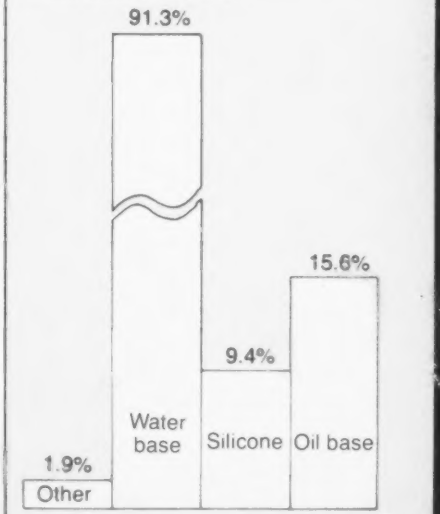
| Type | Now have installed: Number of plants | Number of machines | Average/ plant | Projected ind. total | Plan to buy by end 1982: Number of plants | Number of machines |
|---|---|---|---|---|---|---|
| Automatic ladles | 63 | 323 | 2.0 | 1600 | 31 | 67 |
| Automatic lubricators | 74 | 422 | 2.6 | 2000 | 27 | 73 |
| Automatic lube mixers | 35 | 93 | 0.6 | 450 | 10 | 10 |
| Molten metal pumps | 35 | 129 | 0.8 | 630 | 9 | 10 |

*Based on 165 responding plants*

## WHERE DIES ARE MADE

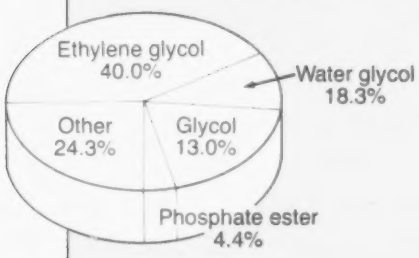



## TYPES OF DIE & PLUNGER LUBRICANT USED




*Based on 160 responding plants*

*Some plants use more than one type of lubricant*




INSTRUMENTATION AND CONTROLS

| Type | Now have installed: Number of plants | Number of machines | Average/ plant | Projected ind. total |
|---|---|---|---|---|
| Pyrometers | 105 | 847 | 6.4 | 5100 |
| Die temperature controls | 52 | 222 | 1.7 | 1300 |
| Furnace controls | 105 | 886 | 6.7 | 5300 |
| Shot controls | 41 | 182 | 1.4 | 1100 |
| Metal temperature controls | 88 | 903 | 6.8 | 5400 |
| Automatic process sequencing | 65 | 759 | 5.7 | 4500 |

**Based on 133 responding plants**

and controls also seems to be increasing.

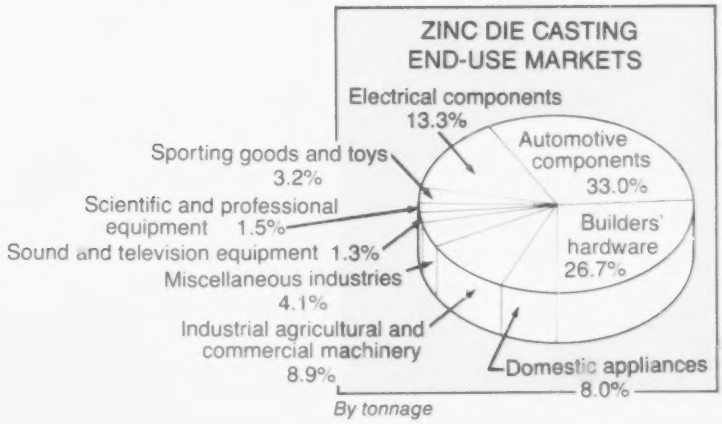
Most dies are still made by outside die makers. The use of petroleum hydraulic fluids has almost vanished.

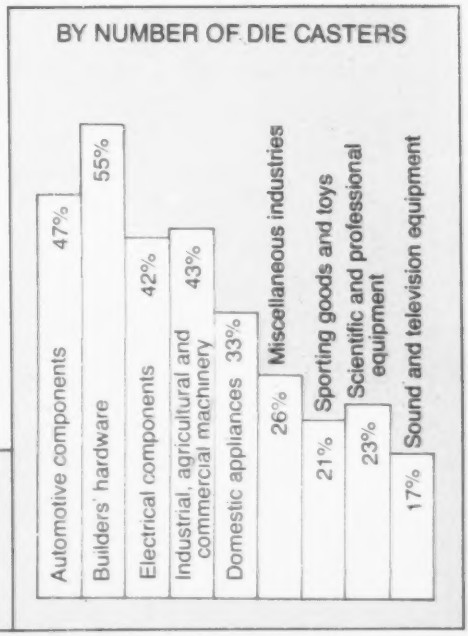
Die castings are still being used largely in their traditional market areas. Automobiles, hardware, machinery, appliances and electrical components are the biggest markets.

Industry expendable supplies usage was estimated by taking the ratio of known die casting shipments (U.S. Dept. of Commerce) to our respondents' shipments, and multiplying our respondents' shipments by this ratio.

EXPENDABLE SUPPLIES

| Type | Number of respondents | Respondents used | Average/ plant | Projected ind. total |
|---|---|---|---|---|
| Die steel | 108 | 1,213,840 lb | 11,239 lb | 6,100,000 lb |
| Die & plunger lube | 126 | 215,489 gal | 1,710 gal | 1,000,000 gal |
| Hydraulic fluid | 126 | 312,903 gal | 2,483 gal | 1,500,000 gal |
| Crucibles | 49 | 542 | 4.0 | 2100 |
| Goosenecks | 78 | 507 | 3.8 | 2000 |
| Melting kettles | 66 | 513 | 3.8 | 1900 |
| Plunger tips | 91 | 8506 | 63.5 | 35,000 |
| Die heaters | 42 | 447 | 3.3 | 1900 |
| Nozzles | 82 | 1264 | 9.4 | 5200 |
| Shot sleeves | 81 | 1206 | 9.0 | 4600 |
| Plunger rings | 74 | 8379 | 62.5 | 35,000 |
| Thermocouple tubes | 90 | 4818 | 36.0 | 19,000 |
| Ladles & skimmers | 97 | 4777 | 35.6 | 19,000 |
| Die lubricators (manual) | 53 | 674 | 5.0 | 2700 |





BY NUMBER OF DIE CASTERS
Automotive components 47%
Builders' hardware 55%
Electrical components 42%
Industrial, agricultural and commercial machinery 43%
Domestic appliances 33%
Miscellaneous industries 26%
Sporting goods and toys 21%
Scientific and professional equipment 23%
Sound and television equipment 17%

*Tonnage breakdown gives percentage of die casting shipments going into each industry; number of die casters gives percentage of zinc die casters involved in producing components for each industry. Zinc Institute says that there are 443 zinc die casters.*

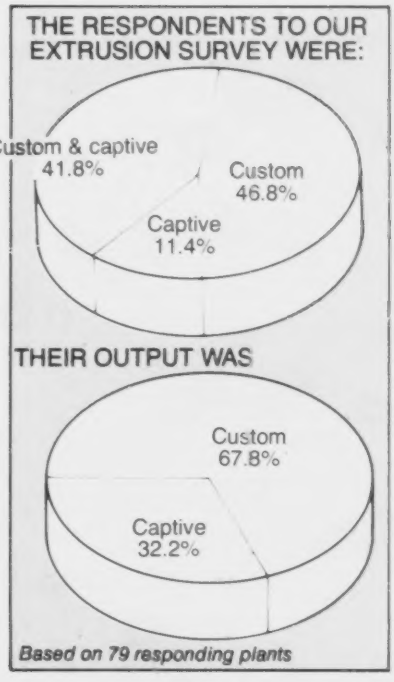
*Source. Zinc Institute Inc.*

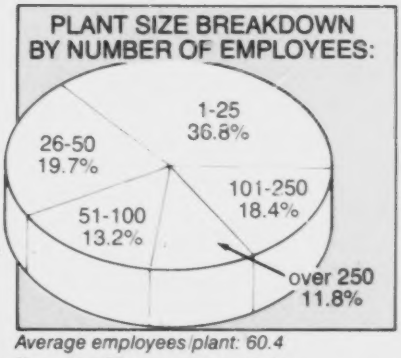
# STATE OF THE EXTRUSION INDUSTRY

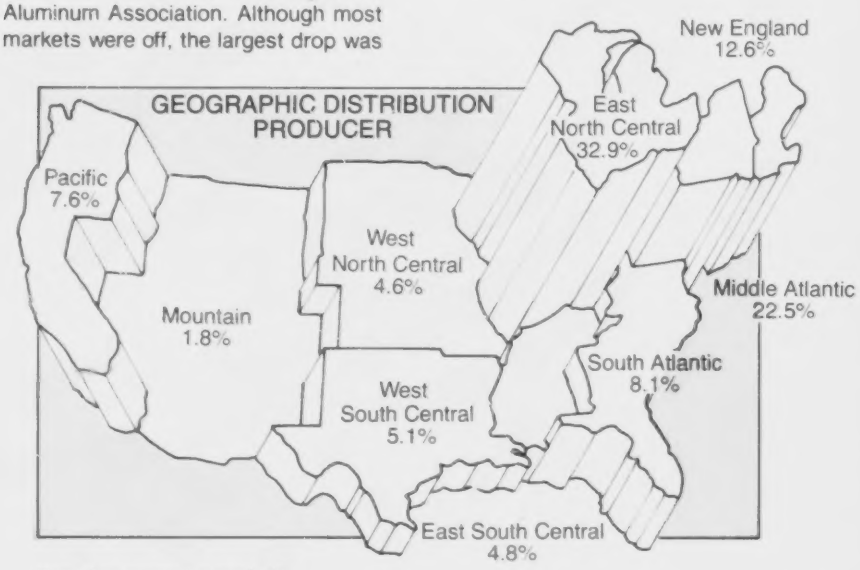
Questionnaires were sent to 1026 production and management executives in the extrusion industry. A total of 79 usable responses was obtained for a response rate of 7.7%. An industry total of 225 plants was assumed for the purpose of estimating industry totals.

Our respondents' output in 1980 was more than two-thirds custom. A large portion of this came from plants producing both custom and captive extrusions, however.

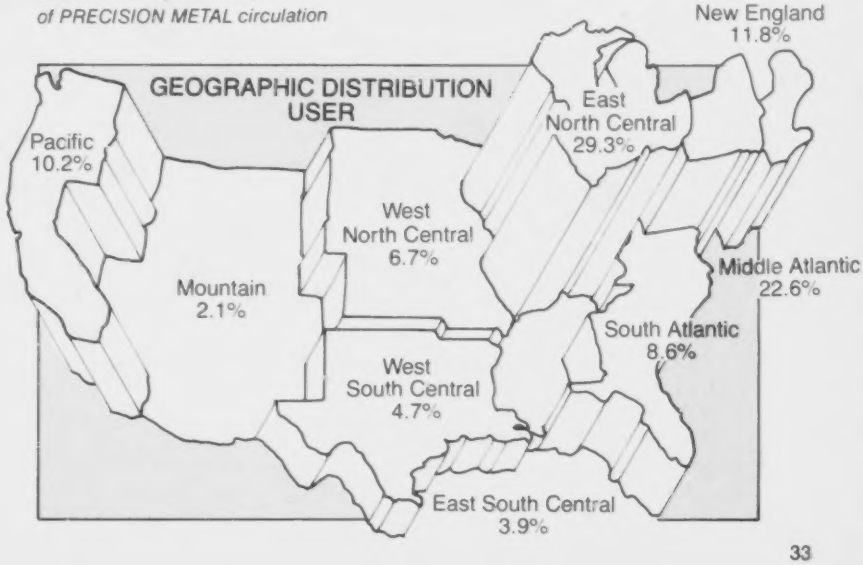
Aluminum extrusion shipments were off about 9% in 1980, according to the Aluminum Association. Although most markets were off, the largest drop was in transportation. The building & construction market did not suffer greatly, perhaps due to a good year in office construction. Extruded pipe & tube was also off slightly in 1980. Pipe & tube shipments have not returned to their peak levels of the mid-1970's. Our respondents expect increased shipments in 1981 with further increases in 1982. Extrusion plants tend to have large shipment weights—note that the larg-




*Based on computer analysis of PRECISION METAL circulation*



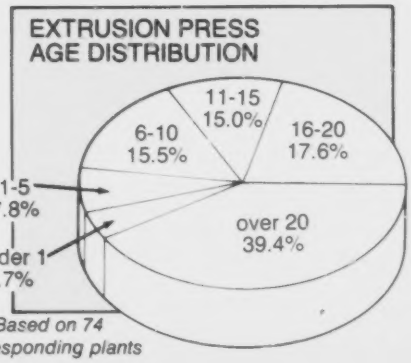
| ALUMINUM EXTRUSION SHIPMENTS, 1971-1980 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
| **Extruded shapes** | | | | | | | | | | |
| Building & construction | 1087 | 1250 | 1302 | 1074 | 812 | 1019 | 1163 | 1235 | 1215 | 1176 |
| Transportation | 227 | 328 | 437 | 424 | 234 | 350 | 427 | 491 | 499 | 390 |
| Consumer durables | 71 | 85 | 113 | 109 | 70 | 94 | 106 | 133 | 117 | 96 |
| Electrical | 91 | 97 | 114 | 117 | 78 | 94 | 89 | 101 | 106 | 88 |
| Machinery & equipment | 57 | 67 | 79 | 84 | 72 | 81 | 88 | 115 | 108 | 88 |
| Containers & packaging | 1 | 1 | — | — | — | — | — | — | 1 | — |
| Other | 52 | 48 | 49 | 48 | 33 | 43 | 31 | 24 | 28 | 37 |
| Domestic total | 1586 | 1876 | 2094 | 1856 | 1299 | 1681 | 1904 | 2099 | 2074 | 1875 |
| Exports | 8 | 8 | 17 | 18 | 14 | 10 | 9 | 17 | 22 | 25 |
| **Extruded shapes total** | 1594 | 1884 | 2111 | 1874 | 1313 | 1691 | 1913 | 2116 | 2096 | 1900 |
| **Extruded pipe & tube** | | | | | | | | | | |
| Building & construction | 46 | 47 | 46 | 42 | 27 | 33 | 31 | 29 | 31 | 23 |
| Transportation | 11 | 16 | 20 | 18 | 14 | 18 | 21 | 24 | 18 | 13 |
| Consumer durables | 17 | 20 | 21 | 19 | 13 | 18 | 22 | 28 | 21 | 19 |
| Electrical | 60 | 61 | 69 | 56 | 35 | 46 | 44 | 41 | 37 | 42 |
| Machinery & equipment | 40 | 38 | 55 | 65 | 31 | 53 | 45 | 35 | 29 | 26 |
| Other | 6 | 8 | 8 | 6 | 3 | 3 | 2 | 2 | 2 | 5 |
| Domestic total | 180 | 190 | 219 | 206 | 123 | 171 | 165 | 159 | 138 | 126 |
| Exports | 7 | 5 | 10 | 15 | 14 | 19 | 20 | 15 | 17 | 15 |
| **Pipe & tube total** | 187 | 195 | 229 | 221 | 137 | 190 | 185 | 174 | 155 | 141 |

*All figures are in millions of pounds*
*Source: Aluminum Association*

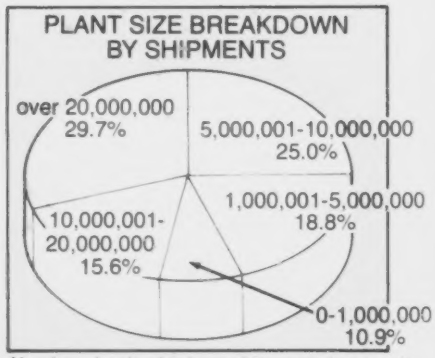
| SHIPMENT TRENDS | | | | |
|---|---|---|---|---|
| Metal or alloy | 1981 change (%) | 1982 expectation (%) | | |
| | | Increase | Decrease | About the same |
| Aluminum | +10.7 | 61.5 | 10.8 | 27.7 |
| Brass | + 7.9 | 42.9 | 7.1 | 50.0 |
| Copper | +10.2 | 100.0 | 0.0 | 0.0 |

*Based on 74 responding plants*

| EXTRUSION PRESSES | | | | | | |
|---|---|---|---|---|---|---|
| Size (tons) | Now installed | | | | Plan to buy by end 1982 | |
| | Number of plants | Number of presses | Average/ plant | Projected ind. total | Number of plants | Number of presses |
| Under 1000 | 14 | 23 | 0.3 | 70 | 3 | 3 |
| 1000-1499 | 29 | 33 | 0.4 | 100 | 0 | 0 |
| 1500-1999 | 28 | 36 | 0.5 | 110 | 2 | 2 |
| 2000-2999 | 34 | 55 | 0.7 | 170 | 4 | 5 |
| 3000-3999 | 24 | 29 | 0.4 | 90 | 2 | 2 |
| 4000-4999 | 2 | 2 | 0.0 | 10 | 0 | 0 |
| 5000-6999 | 6 | 8 | 0.1 | 20 | 0 | 0 |
| 7000 & over | 3 | 4 | 0.1 | 10 | 0 | 0 |
| Total | 74 | 191 | 2.6 | 580 | 11 | 12 |




*Based on 74 responding plants*




*Numbers in pie chart are shipments in pounds*
*Based on 64 responding plants*

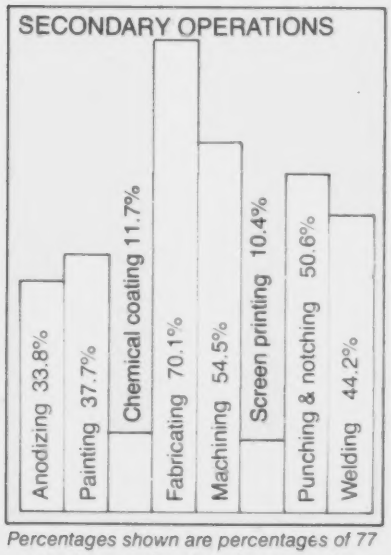
est number of plants fall into the largest shipment category.

Installed extrusion presses are most heavily concentrated in the 100 to 4000-ton ranges. There are relatively few presses with capacities of over 4000 tons. Our respondents' buying plans do not disturb this pattern. There appears to be a potential replacement market for extrusion presses since nearly 40% of installed extrusion presses are over 20 years old.

Most extrusion plants perform one or more secondary operations, with fabricating, machining, punching and notching performed by more than half of the responding plants. Hydraulic fluid

| AUXILIARY EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| Type | Now installed | | | | Plan to buy by end 1982 | |
| | Number of plants | Number of machines | Average/ plant | Projected ind. total | Number of plants | Number of machines |
| Automatic lubricators | 28 | 94 | 1.3 | 280 | 2 | 3 |
| Billet saws | 57 | 116 | 1.5 | 350 | 5 | 5 |
| Billet shears | 13 | 27 | 0.4 | 80 | 6 | 7 |
| Runout tables | 66 | 150 | 2.0 | 450 | 11 | 11 |
| Stretchers, detwisters | 50 | 111 | 1.5 | 330 | 6 | 8 |
| Billet casters | 32 | 84 | 1.1 | 250 | 3 | 3 |
| Billet heaters, induction | 37 | 91 | 1.2 | 270 | 5 | 6 |
| Billet heaters, fuel | 53 | 146 | 1.9 | 440 | 6 | 6 |
| Heat treat ovens | 63 | 220 | 2.9 | 660 | 6 | 6 |
| Cut-off saws | 68 | 348 | 4.6 | 1000 | 8 | 10 |
| Burner controls | 31 | 145 | 1.9 | 440 | 5 | 8 |
| EDM machines | 20 | 46 | 0.6 | 140 | 3 | 3 |
| Heat recovery equipment | 21 | 70 | 0.9 | 210 | 5 | 8 |

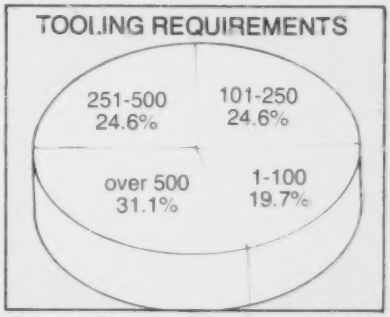
*Based on 75 responding plants*



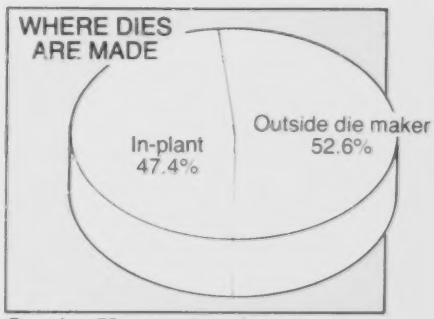

*Percentages shown are percentages of 77 respondents performing given operations.*

| EXPENDABLE SUPPLIES | | | | |
|---|---|---|---|---|
| Type | Number of plants | Respondents used | Average/ plant | Projected ind. total |
| Fire resistant hydraulic fluid | 19 | 29,510 gal | 546 gal | 95,000 gal |
| Petroleum hydraulic fluid | 44 | 259,260 gal | 4801 gal | 840,000 gal |
| Die lubricants | 46 | 49,066 gal | 909 gal | 150,000 gal |
| Graphite | 33 | 40,449 ft² | 749 ft² | 130,000 ft² |

*Based on 55 responding plants*




*Ranges indicate new dies per year per plant*
*Percentages indicate percentage of respondents using dies in given ranges in 1980*
*61 respondents used 34,115 new dies in 1980*
*43% of these were for new shapes*
*Average plant: 559*
*Projected ind. total: 110,000*




*Based on 75 responding plants*

used by extruders is largely petroleum-based.

Over half of our respondents used more than 250 new dies last year. Slightly more than half the dies used last year were made by outside die makers.

Our projections for industry usage of expendable supplies were based on a percentage of shipments method. Known industry extrusion shipment totals from the Aluminum Association were divided by our respondents' reported shipments. Expendable supplies totals reported by our respondents were then multiplied by this ratio to arrive at the projected industry totals.

| DIE SUPPLIES | | | | |
|---|---|---|---|---|
| Type | Number of Plants | Respondents used | Average/ plant | Projected ind. total |
| Dummy blocks | 49 | 4582 | 76.4 | 17,000 |
| Holder blocks | 19 | 1643 | 27.4 | 6200 |
| Containers | 29 | 161 | 2.7 | 600 |
| Rams | 40 | 114 | 1.9 | 430 |
| Liners | 47 | 359 | 6.0 | 1300 |
| Mandrels | 15 | 2812 | 46.9 | 11,000 |

*Based on 60 responding plants*

# STATE OF THE FORGING INDUSTRY

Questionnaires were sent to 2000 management and production executives in the forging industry. We received 209 useful responses for a response rate of 10.5%. An industry total of 900 plants was assumed for the purpose of projecting industry totals.

Custom closed impression die forging shipments were off in 1980. Not only did tonnage drop 22%, but dollar volume actually fell. The drop in tonnage occurred in all metals except stainless steel, titanium and high-temperature alloys. The only market areas to grow in sales dollar volume were aircraft engines, aircraft parts, internal combustion engines, ordnance and oil field machinery. The biggest dip occurred in the trucks and buses category. Indeed, the drop in this category, combined with the increases in aircraft parts and engines, pushed the trucks and buses category, the leader in forging sales through the 1970's, into third place.

The areas that increased in 1980 are not surprising, since these areas of the economy have done well in recent years, particularly oil field machinery. These areas are likely to do well in the near future as well, especially considering increases in defense spending and the continuing search for domestic sources for oil. Other areas are likely to pick up when the economy improves, particularly when interest rates decrease.

Lead times for certain types of forgings, particularly those for aerospace applications, were very long (over 50 weeks, in some cases) two or three years ago. Although this situation has eased, a sudden jump in aerospace orders could make the situation serious again. The staggered procurement plans for defense hardware advocated by some in the industry could be of great help in keeping the situation under control.

The industry is also becoming concerned with forging imports.

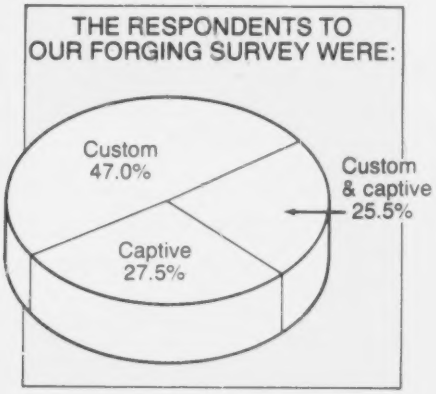
According to our survey, the industry is about 60% custom, with most plants having 50 or fewer employees. The majority of respondents perform closed impression die forging, with significant amounts also performing open die forging and heading or upsetting.

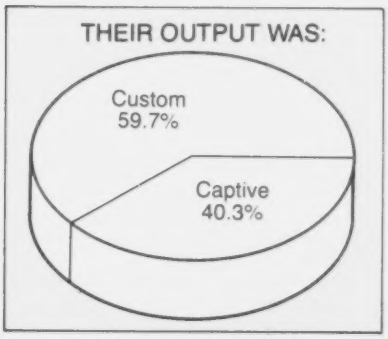
After the off year in 1980, most of our respondents expect slight increases in 1981, with additional improvement in 1982.

Buying plans for hammers seem rather depressed, with our respondents planning to buy only 14 steam or air hammers and one board hammer. The trend appears to be toward presses, with our respondents planning to buy 66 mechanical and 20 hydraulic presses. Buying plans could turn upward in the near future, though, if economic conditions improve and interest rates abate. Much of the industry's forming equipment is over 20 years old, especially the hammers.

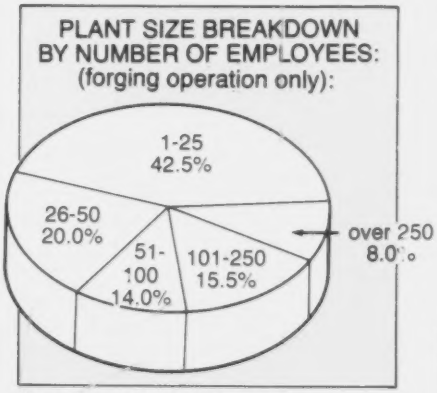
Plans to buy for upsetters and cold headers are also rather limited, especially in the case of cold headers. Upsetter buying plans might also turn up in the next few years, as nearly three-fourths of the upsetters presently installed are over 20 years old.

In heating equipment, the trend away from fuel-fired equipment (especially oil) and toward electric heating equipment (especially induction) continues, with our respondents planning to buy over seven times as many induction as oil-fired furnaces by the end of 1982. Buying plans for gas-fired furnaces are in better shape than those for oil-fired furnaces, perhaps due to more opti-

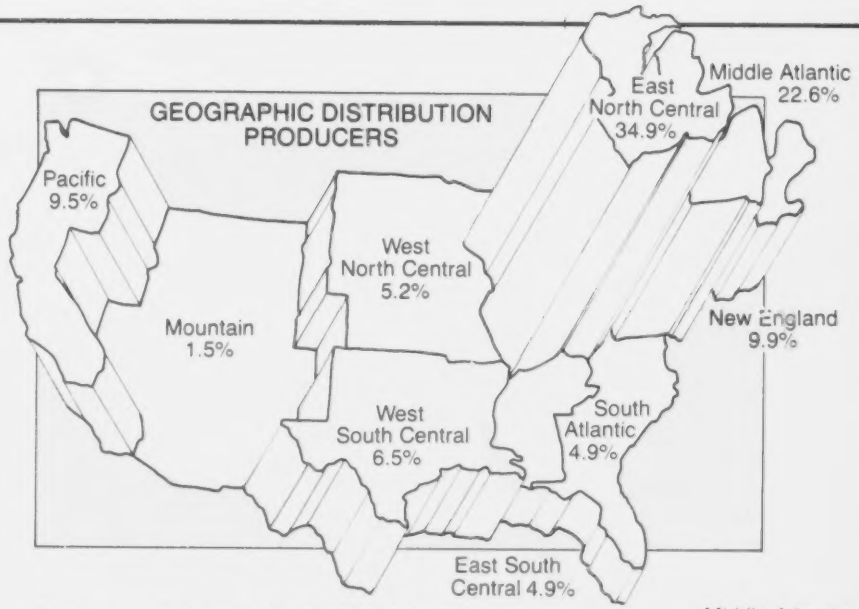


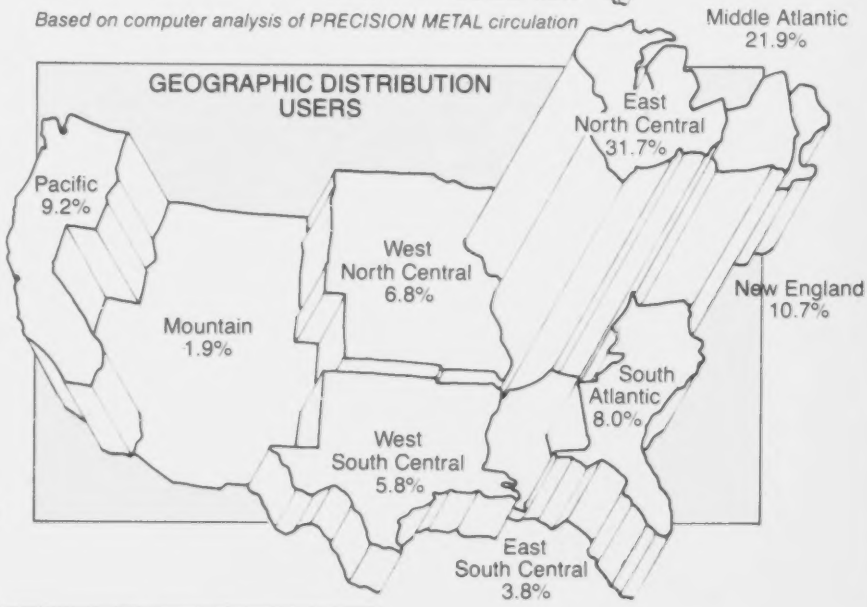

*Based on 204 responding plants*

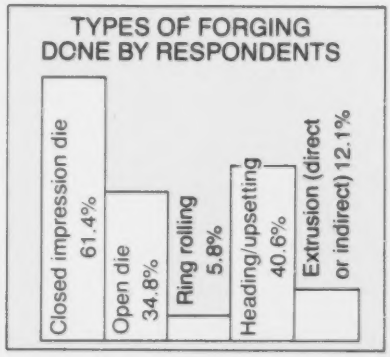



*Average employees/plant: 91.7*
*Based on 200 responding plants*




*Based on computer analysis of PRECISION METAL circulation*




*Based on 207 responding plants*
*Some plants perform more than one type of forging, so percentage total exceeds 100%.*

## FORGING INDUSTRY ASSOCIATION DATA
## SALES OF COMMERCIAL CLOSED DIE FORGINGS 1971-1980

| TYPE OF METAL | 1971 | | 1974 | | 1976 | | 1978 | | 1980 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Dollars | Net. Wt. (tons) | Dollars | Net. Wt. (tons) | Dollars | Net. Wt. (tons) | Dollars | Net. Wt. (tons) | Dollars | Net. Wt. (tons) |
| **FERROUS** | | | | | | | | | | |
| Carbon Steel | 388,488 | 803.6 | 617,346 | 897.1 | 656,800 | 750.6 | 824,730 | 734.1 | 778,316 | 522.0 |
| Common Alloy Steel | 214,492 | 322.3 | 407,804 | 393.7 | 494,100 | 399.1 | 624,744 | 405.5 | 716,995 | 364.5 |
| Stainless Steel | 45,839 | 12.2 | 71,246 | 15.2 | 64,100 | 12.8 | 80,755 | 11.5 | 108,418 | 11.8 |
| TOTAL FERROUS | 648,819 | 1138.1 | 1,096,396 | 1288.0 | 1,215,000 | 1,162.5 | 1,530,031 | 1,150.0 | 1,603,729 | 898.3 |
| **NON-FERROUS** | | | | | | | | | | |
| Aluminum | 82,544 | 31.0 | 129,562 | 37.1 | 141,600 | 32.8 | 223,504 | 40.3 | 285,106 | 32.2 |
| Titanium | 62,854 | 4.4 | 89,327 | 4.9 | 126,200 | 4.6 | 143,971 | 5.1 | 247,514 | 5.4 |
| Brass & Copper | 53,142 | 26.5 | 153,666 | 28.3 | 99,400 | 21.6 | 103,798 | 26.0 | 110,600 | 22.8 |
| Other Nonferrous* | 5,042 | 2.0 | 5,260 | 1.0 | 7,200 | 0.8 | 8,841 | 0.5 | 7,712 | 0.4 |
| TOTAL NONFERROUS | 203,568 | 63.0 | 377,905 | 71.4 | 374,400 | 5.9 | 480,114 | 71.9 | 651,452 | 61.3 |
| TOTAL HI-TEMP** | 81,355 | 6.1 | 108,323 | 8.5 | 124,900 | 6.1 | 157,558 | 7.2 | 287,992 | 8.0 |
| TOTAL $ VOLUME | 933,722 | | 1,582,624 | | 1,714,300 | | 2,167,703 | | 2,543,173 | |

*Other includes magnesium, zinc and other.

**Those alloys whether iron, nickel or cobalt base or others suitable for use at temperatures of 1000F.

All dollar and weight values are expressed in thousands.

This data does not include (1) shipments of aircraft blades and buckets from specialized shops devoted primarily to that work; (2) products forged at temperatures below 300 F; (3) forged "catalog" items; and (4) forgings shipped to affiliated plants or concerns.

## MAJOR END-USE MARKETS

| | 1971 | | 1974 | | 1976 | | 1978 | | 1980 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Ind. Sales $ Volume | % Of Sales | Ind. Sales $ Volume | % Of Sales | Ind. Sales $ Volume | % Of Sales | Ind. Sales $ Volume | $ Of Sales | Ind. Sales $ Volume | % of Sales |
| 1. Farm Machinery | 36,780 | 4.0 | 80,714 | 5.1 | 93,601 | 5.5 | 106,218 | 4.9 | 116,985 | 4.6 |
| 2. Aircraft: | | | | | | | | | | |
| Engines & Engine Parts | 112,980 | 12.1 | 163,010 | 10.3 | 206,745 | 12.1 | 236,280 | 10.9 | 432,339 | 17.0 |
| Aircraft, Parts & | | | | | | | | | | |
| Auxiliary Eqpt. | 92,065 | 9.9 | 151,932 | 9.6 | 184,973 | 10.8 | 234,112 | 10.8 | 439,969 | 17.3 |
| Guided Missiles, Space | | | | | | | | | | |
| Vehicles & Parts | 21,662 | 2.3 | 22,157 | 1.4 | 22,457 | 1.3 | 30,348 | 1.4 | 27,975 | 1.1 |
| 3. Automotive: | | | | | | | | | | |
| Passenger Cars & Parts | 74,885 | 8.0 | 98,123 | 6.2 | 125,315 | 7.3 | 160,410 | 7.4 | 147,504 | 5.8 |
| Trucks, Buses, Trailers | | | | | | | | | | |
| & Related Parts | 127,360 | 13.6 | 261,133 | 16.5 | 295,545 | 17.2 | 398,857 | 18.4 | 312,811 | 12.3 |
| 4. Internal Combustion Engine | 14,379 | 1.4 | 22,157 | 1.4 | 25,029 | 1.5 | 28,180 | 1.3 | 41,866 | 1.6 |
| 5. Metalworking & Special Ind. | | | | | | | | | | |
| (not mtlwrkg) Machinery | 13,259 | 1.6 | 47,479 | 3.0 | 40,457 | 2.3 | 52,025 | 2.4 | 50,863 | 2.0 |
| 6. Mech. Power Transmission Eqpt. | | | | | | | | | | |
| (incl. Bearings) | 13,166 | 1.4 | 25,332 | 1.6 | 20,229 | 1.2 | 43,354 | 2.0 | 40,678 | 1.6 |
| 7. Nuclear | 15,133 | 1.6 | 26,905 | 1.7 | — | — | — | — | — | — |
| 8. Fabricated Plate Work & Special | | | | | | | | | | |
| Ind. Eqpt. not classified | — | — | — | — | 17,657 | 1.0 | 21,677 | 1.0 | 17,802 | 0.7 |
| 9. Off-Highway Eqpt. | 133,655 | 14.1 | 223,150 | 14.1 | 239,831 | 14.0 | 299,143 | 13.8 | 300,094 | 11.8 |
| 10. Ordnance (except missiles) | 56,677 | 6.1 | 61,722 | 3.9 | 77,658 | 4.5 | 58,528 | 2.7 | 78,838 | 3.1 |
| 11. Oil Field Machinery & Eqpt. | 16,714 | 1.8 | 39,566 | 2.5 | 42,686 | 2.5 | 62,836 | 2.9 | 89,001 | 3.5 |
| 12. Plumbing Fixtures, Valves | | | | | | | | | | |
| & Fittings | 32,587 | 3.5 | 94,957 | 6.0 | 78,001 | 4.6 | 95,379 | 4.4 | 86,468 | 3.4 |
| 13. Pumps & Compressors | 15,126 | 1.6 | 11,078 | 0.7 | 8,742 | 0.5 | 13,006 | 0.6 | 25,432 | 1.0 |
| 14. Railroad Eqmt. | 26,238 | 2.8 | 68,053 | 4.3 | 52,972 | 3.1 | 97,547 | 4.5 | 106,813 | 4.2 |
| 15. Refrigeration, Air Conditioning | | | | | | | | | | |
| and Heat Eqpt. | 9,337 | 1.0 | 23,739 | 1.5 | 21,600 | 1.2 | 15,147 | 0.7 | 17,802 | 0.7 |
| 16. Steam Engines & Turbines | 15,406 | 1.7 | 31,652 | 2.0 | 28,972 | 1.7 | 41,186 | 1.9 | 39,529 | 1.6 |
| 17. Other | 108,125 | 11.6 | 129,775 | 8.2 | 131,830 | 7.7 | 173,416 | 8.0 | 170,393 | 6.7 |
| **TOTALS** | **933,734** | **100.0** | **1,582,624** | **100.0** | **1,714,300** | **100.0** | **2,167,703** | **100.0** | **2,543,173** | **100.0** |

## SHIPMENT TRENDS

| CLOSED IMPRESSION DIE | | | | |
|---|---|---|---|---|
| Metal or alloy | 1981 change (%) | 1982 expectation (%) | | |
| | | Increase | Decrease | About the same |
| Carbon steel | + 3.8 | 64.4 | 9.6 | 26.0 |
| Common alloy steel | + 5.0 | 64.2 | 5.6 | 30.2 |
| Stainless steel | +17.0 | 60.9 | 21.7 | 17.4 |
| Aluminum | + 6.3 | 70.0 | 10.0 | 20.0 |
| Titanium | +50.0 | 80.0 | 0.0 | 20.0 |
| Brass & copper | +18.4 | 55.6 | 0.0 | 44.4 |
| Other nonferrous | +25.8 | 60.0 | 0.0 | 40.0 |
| High temperature | + 4.1 | 66.7 | 0.0 | 33.3 |

*Based on 163 responding plants*

| OPEN DIE | | | | |
|---|---|---|---|---|
| Metal or alloy | 1981 change (%) | 1982 expectation (%) | | |
| | | Increase | Decrease | About the same |
| Carbon steel | +19.3 | 43.1 | 17.7 | 39.2 |
| Common alloy steel | + 9.1 | 45.7 | 14.3 | 40.0 |
| Stainless steel | +26.4 | 70.6 | 5.9 | 23.5 |
| Aluminum | −44.4 | 42.9 | 42.9 | 14.2 |
| Titanium | +25.0 | 100.0 | 0.0 | 0.0 |
| Brass & copper | + 2.2 | 42.9 | 14.2 | 42.9 |
| Other nonferrous | +15.1 | 55.6 | 0.0 | 44.4 |
| High temperature | −31.9 | 57.1 | 14.3 | 28.6 |

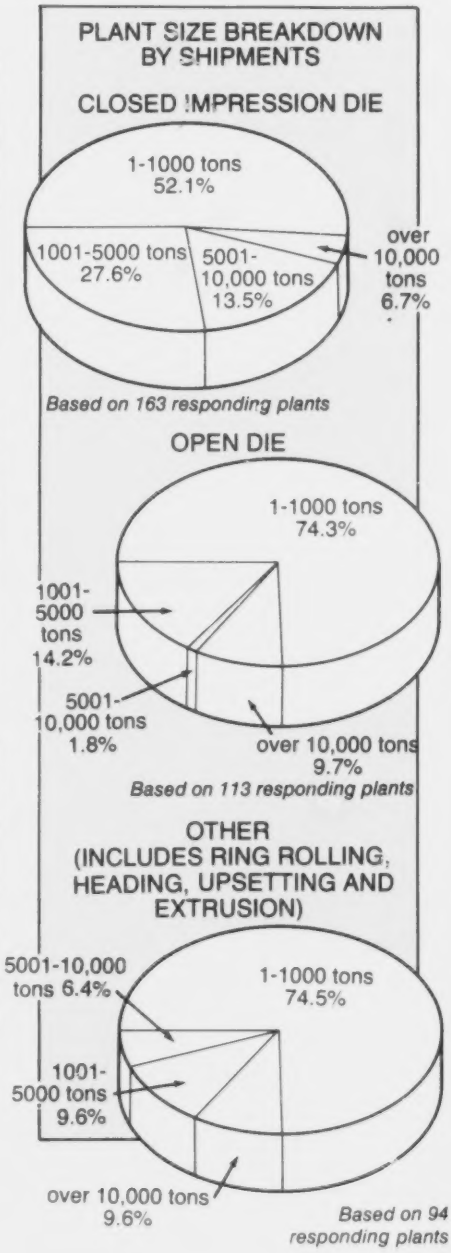
*Based on 113 responding plants*

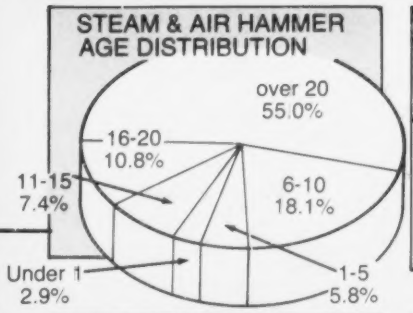
| OTHER (includes ring rolling, heading, upsetting and extrusion) | | | | |
|---|---|---|---|---|
| Metal or alloy | 1981 change (%) | 1982 expectation (%) | | |
| | | Increase | Decrease | About the same |
| Carbon steel | +12.1 | 59.6 | 7.7 | 32.7 |
| Common alloy steel | +29.7 | 61.8 | 5.9 | 32.3 |
| Stainless steel | +13.4 | 37.5 | 12.5 | 50.0 |
| Aluminum | +13.6 | 60.0 | 20.0 | 20.0 |
| Titanium | 0.0 | 33.3 | 0.0 | 66.7 |
| Brass & copper | + 5.6 | 40.0 | 0.0 | 60.0 |
| Other nonferrous | +61.5 | 33.3 | 0.0 | 66.7 |
| High temperature | 0.0 | 33.3 | 0.0 | 66.7 |

*Based on 94 responding plants*

*The 1981 change column represents respondents' expected change in shipment poundage from 1980, expressed in percent.*

*The 1982 expectation columns give the percentage of respondents expecting 1982 shipments to increase, decrease or stay about the same as 1981.*

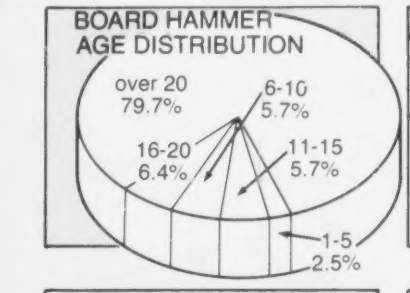





## STEAM & AIR HAMMERS

| Size (pounds) | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of hammers | Average/ plant | Projected ind. total | Number of plants | Number of hammers |
| Less than 1000 | 20 | 61 | 0.3 | 290 | 0 | 0 |
| 1001-5000 | 75 | 339 | 1.8 | 1600 | 8 | 10 |
| 5001-10,000 | 44 | 90 | 0.5 | 420 | 0 | 0 |
| 10,001-25,000 | 12 | 17 | 0.1 | 80 | 1 | 1 |
| over 25,000 | 3 | 3 | 0.0 | 10 | 2 | 3 |
| Total | 88 | 510 | 2.7 | 2400 | 11 | 14 |

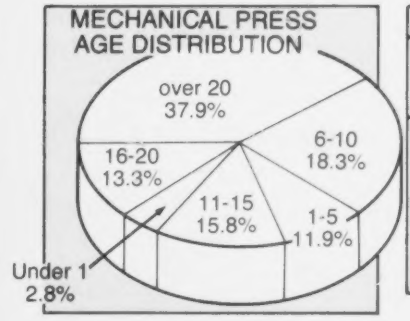
*Based on 191 responding plants*




## BOARD HAMMERS

| Size (pounds) | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of hammers | Average/ plant | Projected ind. total | Number of plants | Number of hammers |
| Less than 1000 | 17 | 51 | 0.3 | 240 | 0 | 0 |
| 1001-5000 | 51 | 259 | 1.4 | 1200 | 1 | 1 |
| 5001-10,000 | 2 | 3 | 0.0 | 10 | 0 | 0 |
| 10,001-25,000 | 0 | 0 | 0.0 | 0 | 0 | 0 |
| Total | 56 | 310 | 1.6 | 1500 | 1 | 1 |

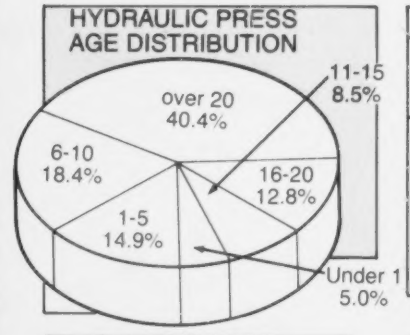
*Based on 191 responding plants*




## MECHANICAL PRESSES

| Size (tons) | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of presses | Average/ plant | Projected ind. total | Number of plants | Number of presses |
| 100-500 | 30 | 173 | 0.9 | 820 | 9 | 19 |
| 501-1000 | 32 | 89 | 0.5 | 420 | 3 | 30 |
| 1001-2000 | 37 | 91 | 0.5 | 430 | 10 | 11 |
| 2001-5000 | 23 | 76 | 0.4 | 360 | 4 | 5 |
| 5001-10,000 | 6 | 8 | 0.0 | 40 | 1 | 1 |
| over 10,000 | 4 | 5 | 0.0 | 20 | 0 | 0 |
| Total | 78 | 442 | 2.3 | 2100 | 23 | 66 |

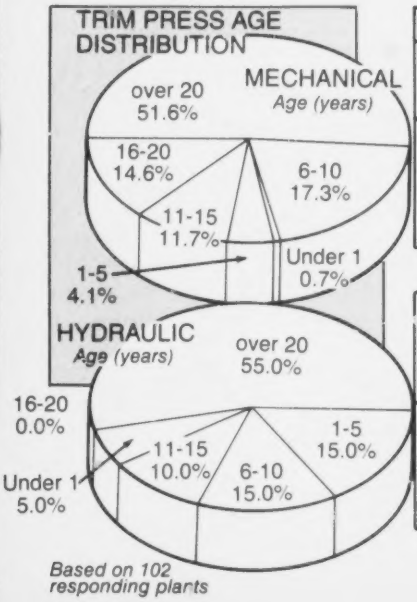
*Based on 191 responding plants*




## HYDRAULIC PRESSES

| Size (tons) | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of presses | Average/ plant | Projected ind. total | Number of plants | Number of presses |
| 100-500 | 28 | 54 | 0.3 | 250 | 2 | 3 |
| 501-1000 | 18 | 28 | 0.1 | 130 | 3 | 5 |
| 1001-2000 | 20 | 26 | 0.1 | 120 | 4 | 7 |
| 2001-5000 | 12 | 22 | 0.0 | 100 | 3 | 3 |
| 5001-10,000 | 4 | 5 | 0.0 | 20 | 1 | 1 |
| over 10,000 | 5 | 7 | 0.7 | 30 | 1 | 1 |
| Total | 56 | 142 | | 670 | 11 | 20 |

*Based on 191 responding plants*




## TRIM PRESSES-MECHANICAL

| Size (tons) | Now installed | | | | Plan to by by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of presses | Average/ plant | Projected ind. total | Number of plants | Number of presses |
| 50-200 | 92 | 894 | 4.7 | 4200 | 14 | 70 |
| 201-300 | 28 | 102 | 0.5 | 480 | 3 | 4 |
| 301-400 | 16 | 29 | 0.2 | 140 | 1 | 1 |
| over 400 | 17 | 36 | 0.2 | 170 | 3 | 3 |
| Total | 110 | 1061 | 5.6 | 5000 | 20 | 78 |

*Based on 191 responding plants*

## TRIM PRESSES-HYDRAULIC

| Size (tons) | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of presses | Average/ plant | Projected ind. total | Number of plants | Number of presses |
| 50-200 | 8 | 10 | 0.1 | 50 | 1 | 2 |
| 201-300 | 5 | 8 | 0.0 | 40 | 1 | 1 |
| 301-400 | 1 | 2 | 0.0 | 10 | 0 | 0 |
| over 400 | 1 | 1 | 0.0 | 10 | 0 | 0 |
| Total | 15 | 21 | 0.1 | 100 | 1 | 3 |

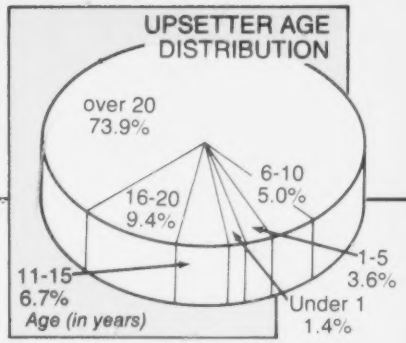
*Based on 191 responding plants*

*Based on 102 responding plants*

## UPSETTERS

| Size (in.) | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of upsetters | Average/ plants | Projected ind. total | Number of plants | Number of upsetters |
| 1/2 | 5 | 9 | 0.0 | 40 | 1 | 1 |
| 1 | 14 | 22 | 0.1 | 100 | 0 | 0 |
| 1-1/2 | 23 | 41 | 0.2 | 190 | 2 | 2 |
| 2 | 18 | 35 | 0.2 | 170 | 2 | 9 |
| 2-1/2 | 11 | 27 | 0.1 | 130 | 1 | 13 |
| 3—4 | 28 | 62 | 0.3 | 290 | 1 | 5 |
| 5—6 | 16 | 50 | 0.3 | 240 | 1 | 3 |
| Total | 67 | 246 | 1.3 | 1200 | 8 | 33 |

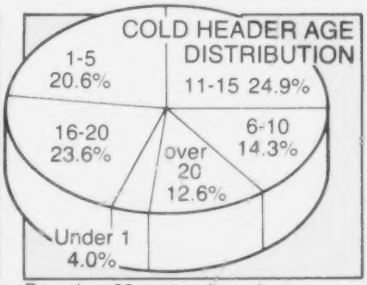
*Based on 191 responding plants*




## COLD HEADERS

| Size (in.) | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of headers | Average/ plant | Projected ind. total | Number of plants | Number of headers |
| 1/8—1/4 | 10 | 129 | 0.7 | 610 | 2 | 9 |
| 1/4—1/2 | 12 | 111 | 0.6 | 520 | 2 | 4 |
| 1/2—3/4 | 8 | 44 | 0.2 | 210 | 2 | 3 |
| 3/4—1 | 9 | 18 | 0.1 | 90 | 1 | 1 |
| over 1 | 3 | 10 | 0.1 | 50 | 2 | 2 |
| Total | 19 | 312 | 1.6 | 1500 | 7 | 19 |

*Based on 191 responding plants*




*Based on 83 responding plants*

## BAR & BILLET HEATERS — OIL FIRED

| Type | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of heaters | Average/ plant | Projected ind. total | Number of plants | Number of heaters |
| Box | 20 | 162 | 0.8 | 760 | 2 | 3 |
| Rotary hearth | 8 | 20 | 0.1 | 90 | 1 | 1 |
| Continuous belt | 2 | 3 | 0.0 | 10 | 1 | 2 |
| Slot | 27 | 280 | 1.5 | 1300 | 4 | 4 |
| Pusher | 5 | 14 | 0.1 | 70 | 0 | 0 |
| Total | 50 | 479 | 2.5 | 2300 | 7 | 10 |

*Based on 191 responding plants*

## BAR & BILLET HEATERS — GAS FIRED

| Type | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of heaters | Average/ plant | Projected ind. total | Number of plants | Number of heaters |
| Box | 53 | 300 | 1.6 | 1400 | 12 | 28 |
| Rotary hearth | 19 | 55 | 0.3 | 260 | 2 | 3 |
| Roller hearth | 5 | 8 | 0.0 | 40 | 0 | 0 |
| Continuous belt | 13 | 72 | 0.4 | 340 | 4 | 8 |
| Slot | 41 | 304 | 1.6 | 1400 | 5 | 8 |
| Pusher | 10 | 20 | 0.1 | 90 | 0 | 0 |
| Total | 100 | 759 | 4.0 | 3600 | 23 | 47 |

*Based on 191 responding plants*

## BAR & BILLET HEATERS — ELECTRIC

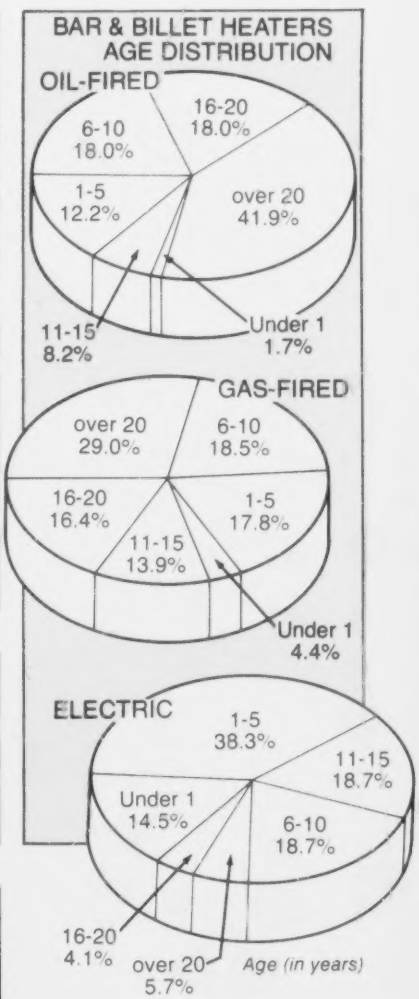
| Type | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of heaters | Average/ plant | Projected ind. total | Number of plants | Number of heaters |
| Induction | 82 | 333 | 1.7 | 1600 | 35 | 72 |
| Resistance | 34 | 96 | 0.5 | 450 | 6 | 7 |
| Total | 100 | 429 | 2.2 | 2000 | 39 | 79 |

*Based on 191 responding plants*

## HEAT TREATING FURNACES

| Type | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of furnaces | Average/ plant | Projected ind. total | Number of plants | Number of furnaces |
| Induction | 22 | 58 | 0.3 | 270 | 5 | 10 |
| Fuel-fired | 111 | 743 | 3.9 | 3500 | 20 | 46 |
| Total | 119 | 801 | 4.2 | 3800 | 25 | 56 |

*Based on 191 responding plants*

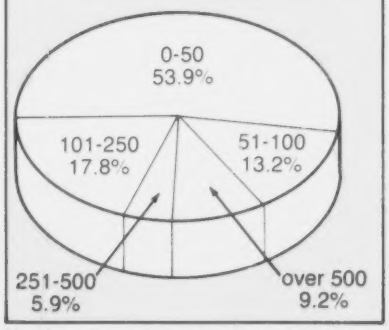


## AUXILIARY EQUIPMENT

| Type | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of machines | Average/ plant | Projected ind. total | Number of plants | Number of machines |
| Automatic lubricators | 44 | 281 | 1.5 | 1300 | 8 | 37 |
| Bar unscramblers | 27 | 59 | 0.3 | 280 | 2 | 3 |
| Billet saws | 90 | 276 | 1.4 | 1300 | 11 | 21 |
| Billet shears | 88 | 229 | 1.2 | 1100 | 9 | 9 |
| Blast cleaning equipment | 102 | 236 | 1.2 | 1100 | 8 | 12 |
| Conveyors | 50 | 415 | 2.2 | 2000 | 12 | 35 |
| Die making machinery: | | | | | | |
| EDM | 60 | 147 | 0.8 | 690 | 9 | 14 |
| Duplicating | 49 | 169 | 0.9 | 800 | 4 | 6 |
| Hobbing | 8 | 28 | 0.1 | 130 | 1 | 1 |
| N/C | 22 | 58 | 0.3 | 270 | 3 | 5 |
| Manipulators | 26 | 76 | 0.4 | 360 | 6 | 11 |
| P/M presses for preform prd. | 4 | 4 | 0.0 | 20 | 0 | 0 |
| Recuperators | 11 | 29 | 0.2 | 140 | 10 | 32 |
| Ring rollers | 5 | 5 | 0.0 | 20 | 1 | 1 |
| Robots | 11 | 31 | 0.2 | 150 | 7 | 12 |
| Sintering furnaces | 9 | 86 | 0.5 | 410 | 4 | 11 |
| Temperature instrumentation | 76 | 541 | 2.8 | 2500 | 11 | 45 |
| Process control systems: | | | | | | |
| For furnaces | 35 | 415 | 2.2 | 2000 | 8 | 23 |
| For forming equipment | 12 | 39 | 0.2 | 180 | 2 | 6 |

*Based on 191 responding plants*

## TOOLING REQUIREMENTS




*Numbers in wedges on pie chart indicate number of dies per plant*

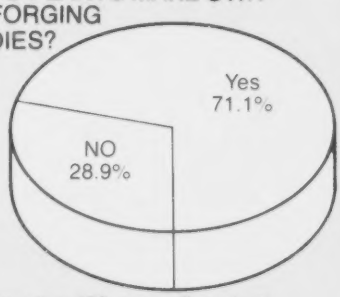
*Based on 146 responding plants*
*Total: 44,227 new dies*
*Average per plant: 303*
*Projected industry total: 270,000 new dies in 1980*

## EXPENDABLE SUPPLIES

| Type | Number of plants | Amount used by respondents | Average/ plant | Projected ind. total |
|---|---|---|---|---|
| Hot work die steel | 91 | 7,206,207 lb | 56,298 lb | 46,000,000 lb |
| Die lube (undiluted) | 81 | 422,490 gal | 3301 gal | 2,800,000 gal |
| Fire resistant hydraulic fluid | 45 | 69,457 gal | 540 gal | 400,000 gal |
| Firebrick | 58 | 327,570 | 2559 | 2,100,000 |
| Ceramic fiber insulation | 34 | 54,790 ft² | 428 ft² | 360,000 ft² |
| Blast cleaning supplies: | | | | |
| Sand | 16 | 135,647 lb | 1060 lb | 710,000 lb |
| Shot | 58 | 2,918,650 lb | 22,802 lb | 19,000,000 lb |
| Glass beads | 10 | 59,600 lb | 466 lb | 400,000 lb |
| Abrasive wheels | 57 | 65,005 | 510 | 410,000 |

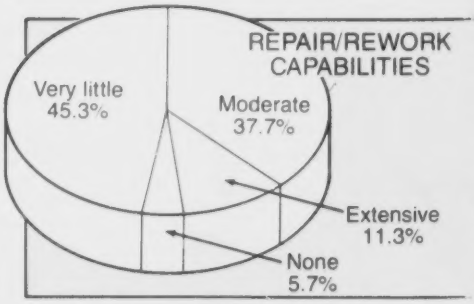
*Based on 128 responding plants*

## DO PLANTS MAKE OWN FORGING DIES?



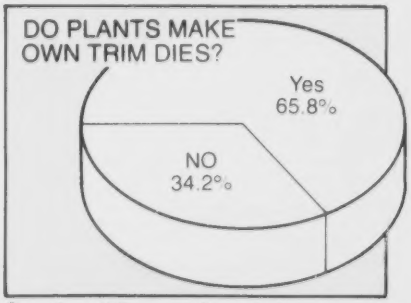

*Based on 190 responding plants*

## REPAIR/REWORK CAPABILITIES




*These are rework/repair capabilities of plants that do not make their own dies.*
*Based on 53 responding plants*

## DO PLANTS MAKE OWN TRIM DIES?




*Based on 158 responding plants*

mistic forecasts of future gas availability.

Most heat treating furnaces are still fuel-fired, and this situation should continue, according to our respondents' buying plans. One area of auxiliary equipment that is receiving increased attention is recuperators for fuel-fired furnaces that save fuel by using hot exhaust gases to preheat incoming combustion air. Note that our respondents plan to buy more recuperators than they presently have installed. Process control systems are presently increasing their penetration of the forging industry, although most are being installed on furnaces, rather than forming equipment.

Most forging plants (over 70%) make their own forging dies, and nearly two-thirds make their own trim dies. All but a handful of plants have some rework/repair capabilities.

Projections for expendable supplies were made by taking the known custom closed impression die shipments (from FIA) and dividing this by respondents' custom closed die shipments. This ratio was then multiplied by respondents' expendable supplies totals to project industry totals.

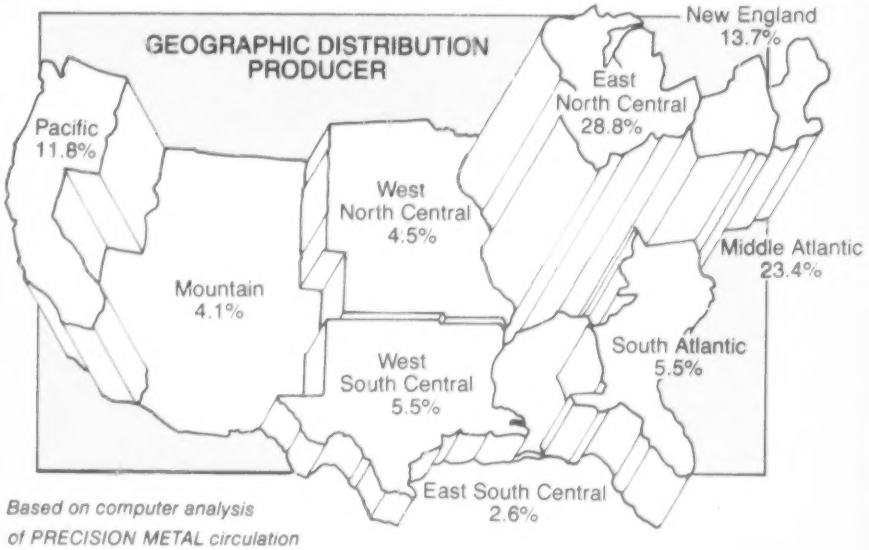
# INVESTMENT CASTING

## STATE OF THE INDUSTRY

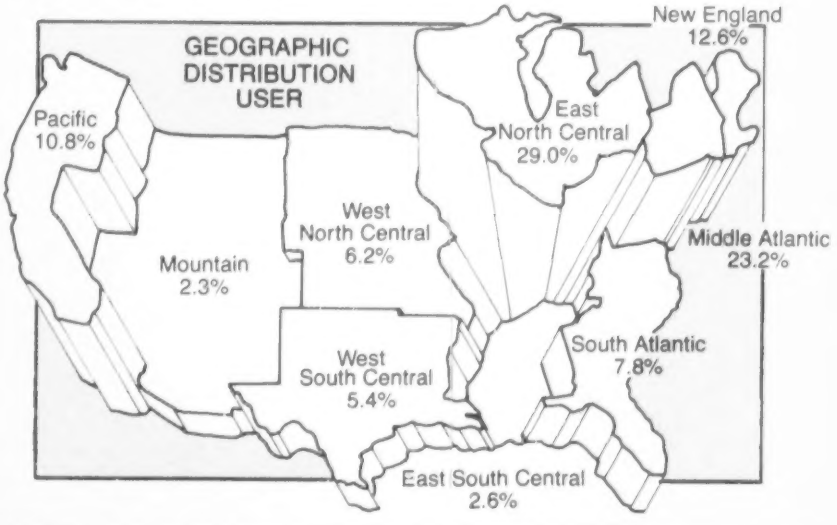
Questionnaires were sent to 554 management and production executives in the investment casting industry. A total of 86 usable responses was obtained for a response rate of 15.5%. An industry total of 300 plants was assumed.

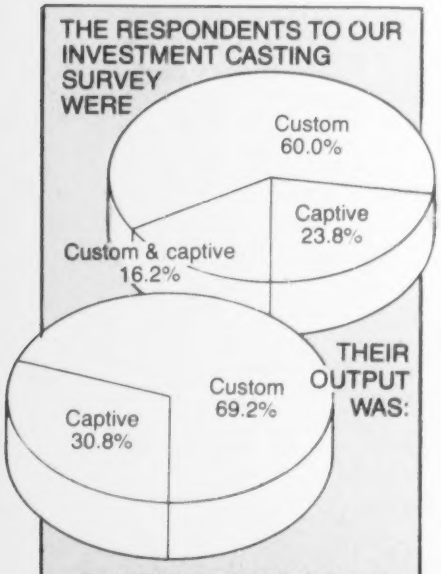
The investment casting industry is largely custom, with about 70% of the output of our respondents being for resale. Investment casting is among the most labor-intensive of the precision metal industries, with an average of over 100 employees/plant.

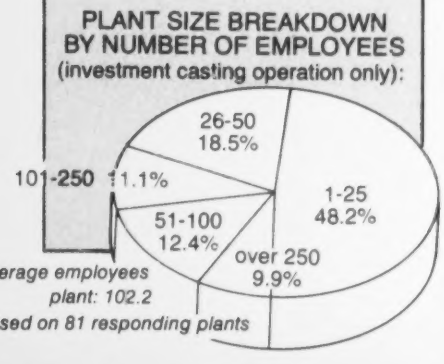
Although the industry was started to produce parts for aircraft engines, the industry has diversified into other market areas. The outlook for future growth seems good, both in the aerospace and industrial areas.




*Based on computer analysis of PRECISION METAL circulation*



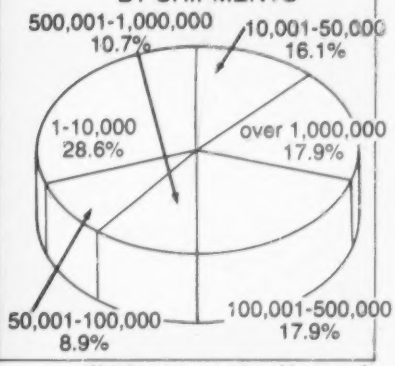




*Average employees plant: 102.2*
*Based on 81 responding plants*

| SHIPMENTS (1980) | | | |
|---|---|---|---|
| Metal or alloy | Number of plants | Respondents shipped (lb) | Projected ind. total (lb) |
| Aluminum | 18 | 1,228,120 | 6,600,000 |
| Copper | 17 | 5,319,425 | 29,000,000 |
| Titanium | 1 | 5000 | 27,000 |
| Low carbon steel | 16 | 3,951,000 | 21,000,000 |
| High carbon steel | 10 | 755,250 | 4,000,000 |
| Low alloy steel | 19 | 3,556,000 | 19,000,000 |
| High alloy steel | 11 | 1,427,000 | 7,600,000 |
| Stainless steel | 32 | 9,544,500 | 51,000,000 |
| Superalloys | 15 | 3,814,550 | 20,000,000 |
| High temperature alloys | 8 | 827,000 | 4,400,000 |
| **Total** | 56 | 30,827,845 | 160,000,000 |

# INVESTMENT CASTING
*continued*

## PLANT SIZE BREAKDOWN BY SHIPMENTS




*Weights are expressed in pounds*
*Based on 56 responding plants*

## SHIPMENT TRENDS

| Metal or alloy | 1981 change (%) | 1982 expectation (%) Increase | Decrease | About the same |
|---|---|---|---|---|
| Aluminum | +14.3% | 53.9 | 11.5 | 34.6 |
| Copper | + 6.9 | 55.0 | 5.0 | 40.0 |
| Titanium | +40.0 | 100.0 | 0.0 | 0.0 |
| Low carbon steel | + 0.7 | 63.2 | 15.8 | 21.1 |
| High carbon steel | +19.2 | 58.3 | 0.0 | 41.7 |
| Low alloy steel | +26.4 | 63.6 | 9.1 | 27.3 |
| High alloy steel | +18.7 | 55.6 | 5.6 | 38.9 |
| Stainless steel | +20.8 | 69.4 | 2.8 | 27.8 |
| Superalloys | − 5.2 | 44.4 | 16.7 | 38.9 |
| High temperature alloys | − 3.5 | 66.7 | 16.7 | 16.7 |

*Based on 56 responding plants*

*The 1981 change column represents respondents' expected change in shipment poundage from 1980, expressed in percent.*

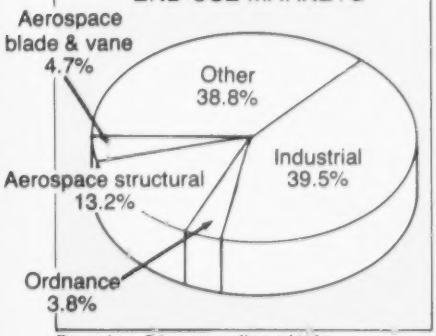
*The 1982 expectation columns give the percentage of respondents expecting 1982 shipments to increase, decrease or stay about the same as 1981.*

## CAPITAL EQUIPMENT

| Type | Now installed Number of plants | Number of machines | Average/ plant | Projected ind. total | Plan to buy by end 1982 Number of plants | Number of machines |
|---|---|---|---|---|---|---|
| Autoclaves | 48 | 67 | 1.1 | 320 | 10 | 10 |
| Blast cleaning equipment | 67 | 204 | 3.3 | 990 | 19 | 30 |
| Burnout furnaces | 59 | 190 | 3.1 | 920 | 23 | 33 |
| Dipping equipment (automatic) | 17 | 85 | 1.4 | 410 | 9 | 13 |
| Fluidized beds | 42 | 174 | 2.8 | 840 | 9 | 30 |
| Furnace controls | 45 | 220 | 3.5 | 1100 | 10 | 22 |
| Heat treating furnaces | 40 | 94 | 1.5 | 460 | 15 | 24 |
| Melting furnaces | 69 | 225 | 3.6 | 1100 | 23 | 42 |
| Microwave dewaxers | 2 | 2 | 0.0 | 10 | 3 | 3 |
| Molten metal furnaces | 21 | 56 | 0.9 | 270 | 5 | 11 |
| Plastic molding machines | 13 | 37 | 0.6 | 180 | 5 | 7 |
| Robots | 13 | 42 | 0.7 | 200 | 11 | 28 |
| Slurry mixers | 51 | 220 | 3.5 | 1100 | 16 | 39 |
| Stucco units | 29 | 123 | 2.0 | 600 | 7 | 17 |
| Vacuum casting equipment | 26 | 69 | 1.1 | 330 | 6 | 8 |
| Vibrating tables | 24 | 38 | 0.6 | 180 | 3 | 8 |
| Wax extruders | 14 | 47 | 0.8 | 230 | 3 | 4 |
| Wax injectors | 54 | 351 | 5.7 | 1700 | 19 | 43 |

*Based on 69 responding plants*

## END USE MARKETS




*Based on 81 responding plants*

## EXPENDABLE SUPPLIES

| Type | Number of plants | Amount used | Average/ plant | Projected ind. total |
|---|---|---|---|---|
| Sand | 29 | 4,260,950 lb | 90,659 lb | 27,000,000 lb |
| Shot | 19 | 448,525 lb | 9543 lb | 2,900,000 lb |
| Grit | 19 | 434,200 lb | 9238 lb | 2,700,000 lb |
| Glass beads | 21 | 65,920 lb | 1402 lb | 420,000 lb |
| Crucibles | 50 | 31,969 | 639 | |
| Cut-off wheels | 46 | 128,414 | 2732 | 820,000 |
| Grinding wheels | 29 | 19,581 | 417 | 120,000 |
| Investment binders | 31 | 515,465 gal | 16,628 gal | 5,000,000 gal |
| Investment materials | 41 | 10,296,450 lb | 251,133 lb | 75,000,000 lb |
| Pattern wax | 41 | 2,720,942 lb | 66,364 lb | 20,000,000 lb |
| Precoat materials | 19 | 2,549,300 lb | 54,240 lb | 134,174 lb |
| Preformed cores | 13 | 160,750 | 3420 | 2,500,000 |

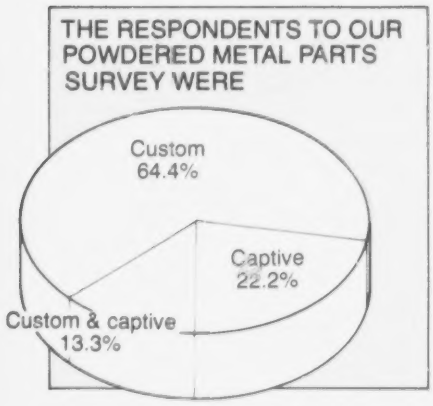
*Based on 47 responding plants*
*It was assumed that all plants used investment binders, investment materials and pattern wax.*

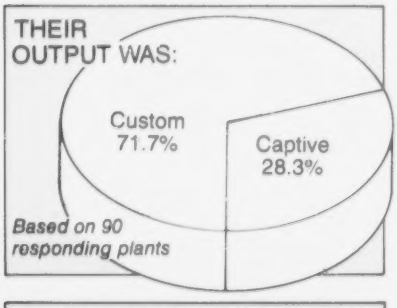
# POWDER METALLURGY

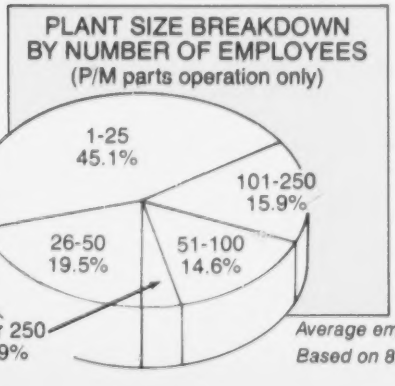
## STATE OF THE INDUSTRY

Questionnaires were sent to 944 management and production executives in the powder metallurgy parts industry. We received a total of 93 usable returns for a response rate of 9.5%. An industry total of 300 plants was assumed for purposes of projecting industry totals.

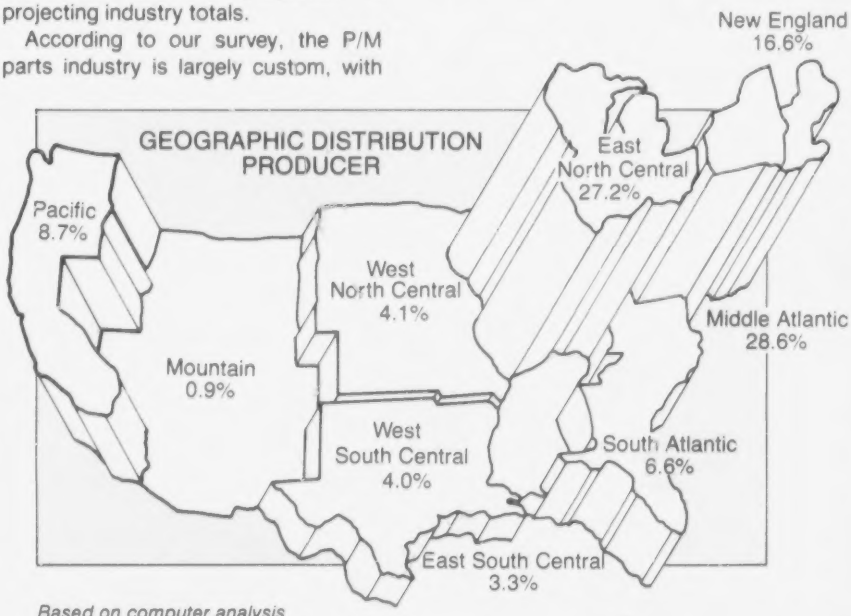
According to our survey, the P/M parts industry is largely custom, with over 70% of our respondents' output for resale. As with most of the precision metal industries, most of the operations have 50 or fewer employees. The industry's production facilities are largely concentrated in the Middle At-



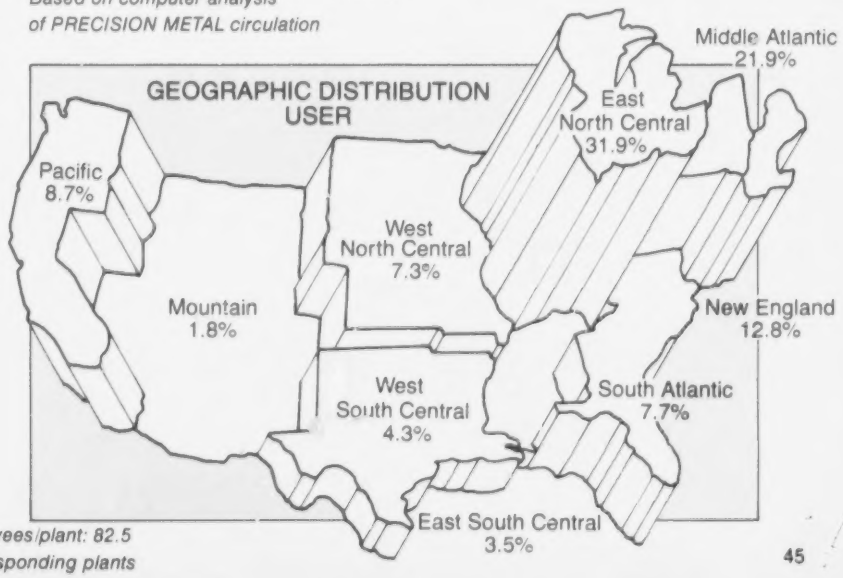




Average employees/plant: 82.5
Based on 82 responding plants

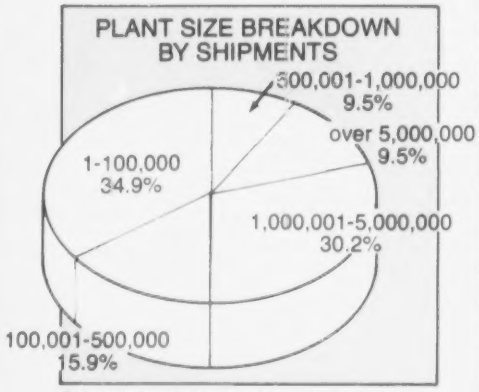



*Based on computer analysis of PRECISION METAL circulation*



# POWDER METALLURGY

*continued*




*Shipment weights are given in pounds*
*Based on 63 responding plants*

lantic and East North Central regions.

By far the greatest shipment poundage is in iron-base parts. Other alloys with significant shipments include aluminum, bronze, stainless steel and tungsten carbide.

The amount of metal powders produced in 1980 was off, according to the Metal Powder Industries Federation. Indeed, the only powder to show an increase over 1979 was tungsten carbide. Iron powder for P/M parts was off 27%. Undoubtedly, a major factor in the decline in P/M parts shipments in 1980 was the performance of the automobile industry. An increase in automobile production would almost certainly lead to a rise in P/M parts shipments. Historically, P/M has a higher growth rate than almost any other precision metal industry. The majority of our respondents do expect an increase in shipments in 1982.

Most of the compacting presses used in the industry are mechanical, with more than three times as many mechanical presses installed as hydraulic. However, our respondents plan to buy fewer than twice as many mechanical presses as hydraulic presses, which seems to continue a previously

**SHIPMENTS (1980)**

| Metal or alloy | Number of plants | Respondents shipped (lb) | Projected ind. total (lb) |
|---|---|---|---|
| Aluminum | 5 | 3,626,376 | 9,100,000 |
| Brass | 13 | 702,790 | 1,800,000 |
| Bronze | 15 | 6,809,800 | 17,000,000 |
| Copper | 6 | 612,020 | 1,500,000 |
| Iron or steel | 38 | 91,524,706 | 230,000,000 |
| Stainless steel | 16 | 1,607,397 | 4,000,000 |
| Tungsten | 3 | 13,000 | 33,000 |
| Tungsten carbide | 3 | 1,980,000 | 5,000,000 |
| Others | 25 | 18,517,960 | 47,000,000 |
| **Total** | 63 | 124,782,029 | 310,000,000 |

**SHIPMENT TRENDS**

| Metal or alloy | 1981 change (%) | 1982 expectation (%) | | |
|---|---|---|---|---|
| | | Increase | Decrease | About the same |
| Aluminum | +99.4 | 46.2 | 0.0 | 53.8 |
| Brass | +32.7 | 55.6 | 11.1 | 33.3 |
| Bronze | −12.8 | 47.8 | 13.0 | 39.1 |
| Copper | + 7.2 | 66.7 | 0.0 | 33.3 |
| Iron or steel | + 5.7 | 72.7 | 6.8 | 20.5 |
| Stainless steel | −11.2 | 57.1 | 19.0 | 23.8 |
| Tungsten | +24.6 | 100.0 | 0.0 | 0.0 |
| Tungsten carbide | + 0.3 | 100.0 | 0.0 | 0.0 |

*Based on 63 responding plants*

**METAL POWDER SHIPMENTS (In Short Tons)**

| | IRON POWDER (P/M Parts Only) | IRON POWDER (Total) | COPPER AND COPPER BASE (Granular) | ALUMINUM (Atomized Granular) |
|---|---|---|---|---|
| 1972 TOTAL | 118,216 | 154,355 | 24,555 | 90,543 |
| 1974 TOTAL | 136,184 | 178,893 | 31,716 | 64,068 |
| 1976 TOTAL | 159,188 | 194,854 | 30,257 | 49,483 |
| 1978 TOTAL | 177,941 | 216,878 | 30,627 | 51,538 |
| 1980 TOTAL | 115,915 | 152,795 | 21,125 | 44,279 |

| | MOLY-BDENUM | TUNGSTEN (Hydrogen Reduced) | TUNGSTEN (Carbide Powder) | NICKEL (Powder & Flake) | TIN POWDER |
|---|---|---|---|---|---|
| 1972 TOTAL | 1,764 | 2,495 | 2,558 | 4,830 | 1,291 |
| 1974 TOTAL | 1,433 | 3,632 | 4,135 | 9,807 | 1,483 |
| 1976 TOTAL | 1,959 | 4,315 | 2,903 | 10,181 | 1,277 |
| 1978 TOTAL | 2,129 | 3,427 | 3,523 | 16,983 | 1,387 |
| 1980 TOTAL | 2,395 | 1,783 | 4,276 | 15,243 | 1,198 |

*NOTE: Iron powder includes iron-base alloys but not stainless alloys and represents U.S.A. as well as Canadian shipments for consumption within these countries. All other powders are U.S.A. shipments for domestic consumption. Nickel powders include flake and are based on imports. Tin powder includes both primary and secondary sources. Tungsten & tungsten carbide powders represent U.S. consumption beginning in 1972; shipments prior to 1972.*

*R = revised figures*
*N/A = Statistics not available at time of publication.*

**LUBRICANTS**

| Type | Number of plants | Respondents used (lb) | Projected ind. total (lb) |
|---|---|---|---|
| Graphite | 31 | 551,975 | 1,400,000 |
| Lithium stearate | 11 | 112,311 | 310,000 |
| Zinc stearate | 33 | 632,554 | 1,6[illegible]000 |
| Stearic acid | 8 | 8,450 | [illegible],000 |
| Wax | 35 | 306,744 | 770,00 |
| Total | 58 | 1,612,034 | 4,400,000 |

## MECHANICAL COMPACTING PRESSES

| Size (tons) | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of presses | Average/ plant | Projected ind. total | Number of plants | Number of presses |
| Under 20 | 48 | 309 | 3.8 | 1100 | 11 | 17 |
| 20-40 | 39 | 211 | 2.6 | 770 | 8 | 13 |
| 41-80 | 32 | 144 | 1.8 | 530 | 9 | 13 |
| 81-100 | 26 | 105 | 1.3 | 380 | 5 | 6 |
| 100-200 | 26 | 73 | 0.9 | 270 | 10 | 13 |
| over 200 | 21 | 52 | 0.6 | 190 | 11 | 17 |
| Total | 64 | 894 | 10.9 | 3300 | 38 | 79 |

*Based on 82 responding plants*

## HYDRAULIC COMPACTING PRESSES

| Size (tons) | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of presses | Average/ plant | Projected ind. total | Number of plants | Number of presses |
| Under 20 | 13 | 60 | 0.7 | 220 | 2 | 10 |
| 20-40 | 20 | 56 | 0.7 | 210 | 6 | 9 |
| 41-80 | 17 | 40 | 0.5 | 150 | 7 | 10 |
| 81-100 | 17 | 23 | 0.3 | 80 | 4 | 5 |
| 101-200 | 16 | 43 | 0.5 | 160 | 2 | 2 |
| over 200 | 22 | 58 | 0.7 | 210 | 4 | 4 |
| Total | 50 | 280 | 3.4 | 1000 | 20 | 40 |

*Based on 82 responding plants*

## ISOSTATIC PRESSES

| Size (tons) | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of presses | Average/ plant | Projected ind. total | Number of plants | Number of presses |
| Under 20 | 3 | 5 | 0.1 | 20 | 2 | 2 |
| 20-40 | 5 | 6 | 0.1 | 20 | 0 | 0 |
| 41-80 | 2 | 4 | 0.0 | 10 | 1 | 1 |
| 81-100 | 0 | 0 | 0.0 | 0 | 0 | 0 |
| 101-200 | 2 | 2 | 0.0 | 10 | 0 | 0 |
| over 200 | 1 | 3 | 0.0 | 10 | 2 | 3 |
| Total | 13 | 20 | 0.2 | 70 | 5 | 6 |

*Based on 82 responding plants*

## COINING PRESSES

| Size (tons) | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of presses | Average/ plant | Projected ind. total | Number of plants | Number of presses |
| Under 20 | 16 | 124 | 1.5 | 450 | 4 | 7 |
| 20-40 | 18 | 80 | 1.0 | 290 | 3 | 4 |
| 41-80 | 17 | 75 | 0.9 | 270 | 4 | 5 |
| 81-100 | 3 | 15 | 0.2 | 50 | 2 | 3 |
| 101-200 | 14 | 36 | 0.4 | 130 | 1 | 2 |
| over 200 | 11 | 23 | 0.3 | 80 | 3 | 5 |
| Total | 36 | 353 | 4.3 | 1300 | 12 | 26 |

*Based on 82 responding plants*

## SINTERING FURNACES

| Type | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of furnaces | Average/ plant | Projected ind. total | Number of plants | Number of furnaces |
| Continuous electric | 53 | 304 | 3.8 | 1100 | 24 | 38 |
| Continuous fuel | 26 | 70 | 0.9 | 260 | 5 | 6 |
| Batch electric | 35 | 195 | 2.4 | 720 | 14 | 25 |
| Batch fuel | 3 | 8 | 0.1 | 30 | 0 | 0 |
| Total | 81 | 577 | 7.1 | 2100 | 35 | 69 |

*Based on 81 responding plants*

## HEAT TREATING FURNACES

| Type | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of furnaces | Average/ plant | Projected ind. total | Number of plants | Number of furnaces |
| Continuous electric | 13 | 40 | 0.5 | 150 | 3 | 3 |
| Continuous fuel | 8 | 15 | 0.2 | 60 | 0 | 0 |
| Batch electric | 21 | 90 | 1.1 | 330 | 3 | 4 |
| Batch fuel | 5 | 7 | 0.1 | 30 | 0 | 0 |
| Total | 39 | 152 | 1.9 | 560 | 6 | 7 |

*Based on 81 responding plants*

| ATMOSPHERE GENERATORS | | | | | | |
|---|---|---|---|---|---|---|
| | Now installed | | | | Plan to buy by end 1982 | |
| Type | Number of plants | Number of machines | Average/ plant | Projected ind. total | Number of plants | Number of machines |
| Hydrogen | 8 | 8 | 0.1 | 30 | 1 | 1 |
| Dissociated ammonia | 37 | 69 | 0.9 | 270 | 3 | 4 |
| Endothermic | 33 | 94 | 1.2 | 360 | 4 | 5 |
| Exothermic | 9 | 25 | 0.3 | 100 | 4 | 4 |
| Nitrogen | 25 | 44 | 0.6 | 170 | 9 | 20 |
| Total | 63 | 240 | 3.1 | 920 | 21 | 34 |

*Based on 78 responding plants*

| AUXILIARY EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| | Now installed | | | | Plan to buy by end 1982 | |
| Type | Number of plants | Number of machines | Average/ plants | Projected ind. total | Number of plants | Number of machines |
| Hopper feeders | 39 | 322 | 4.2 | 1300 | 18 | 51 |
| EDM machines | 27 | 58 | 0.8 | 230 | 8 | 8 |
| Powder blenders | 67 | 180 | 2.4 | 720 | 17 | 18 |
| Impregnating equipment | 30 | 61 | 0.8 | 240 | 8 | 9 |
| Furnace controls | 42 | 440 | 5.9 | 1800 | 16 | 33 |

*Based on 75 responding plants*

mentioned trend toward the use of hydraulic compacting presses. Isostatic presses are still rare.

Most sintering furnaces are electric, with continuous furnaces outnumbering batch units. Our respondents' plans to buy indicate no change in this situation. Most heat treating furnaces in the P/M industry are also electric, with batch furnaces outnumbering electric units this time. Again, plans to buy show no significant trends.

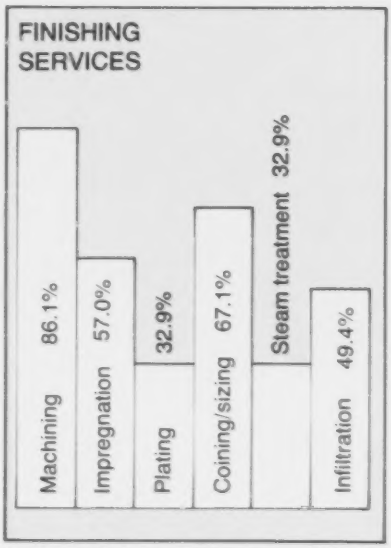
The most popular atmosphere generators are still endothermic units. Dissociated ammonia is the next most popular, followed by nitrogen. Buying plans tell a very different story. Our respondents plan to buy more nitrogen units than the other types combined. Graphite and zinc stearate are the most popular types of lubricants.

Most of our respondents offer finishing services, with machining and coining being offered by most plants. Impregnation is also offered by more than one-half of responding plants.

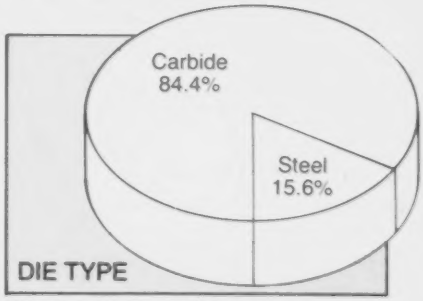
Nearly two-thirds of plants use outside die makers. The great majority of dies are made of carbides.

| OTHER SUPPLIES | | | | |
|---|---|---|---|---|
| Type | Number of plants | Respondents used (1980) | Average/ plant | Projected ind. total |
| Atmosphere | 46 | 1,187,809,600 ft³ | 25,821,948 ft³ | 4,100,00,00 ft³ |
| Furnace belts | 42 | 271 | 3.6 | 1100 |
| Sintering trays | 39 | 24,243 | 324 | 97,000 |

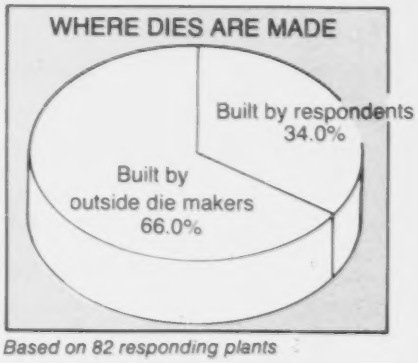
*Based on 75 responding plants*




*Numbers indicate percentage of 79 respondents that performs given service.*




*Based on 78 responding plants*
*70 responding plants used 3796 dies in 1980.*
*Average plant: 54.2*
*Projected industry total: 16,000*



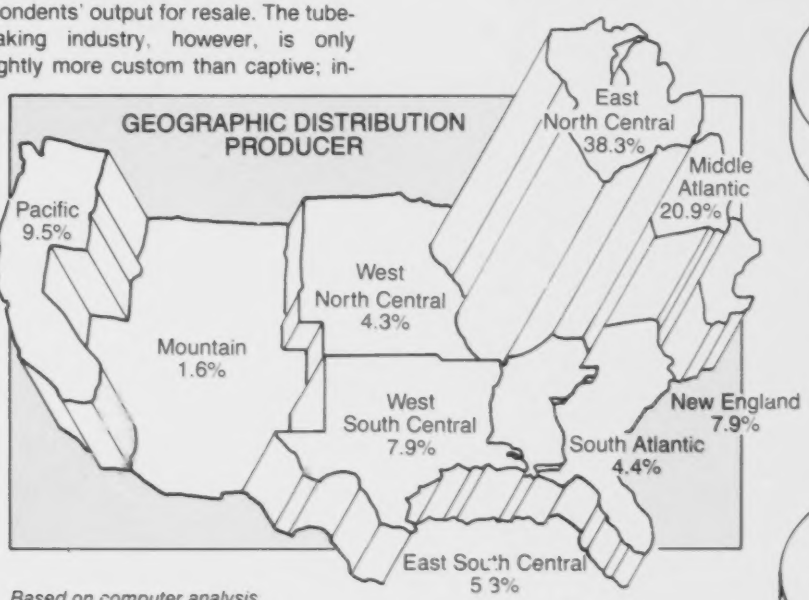

*Based on 82 responding plants*

# ROLL FORMING STATE OF THE INDUSTRY

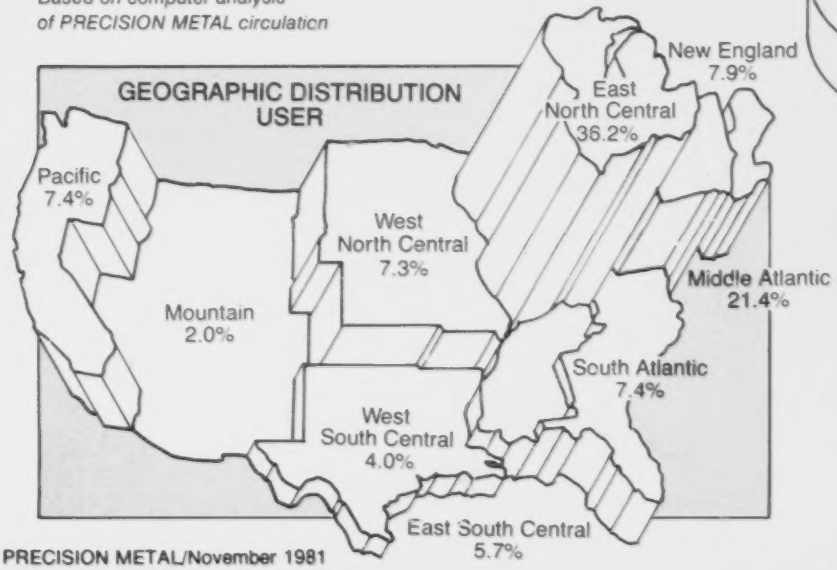
Questionnaires were mailed to 2138 management and production executives in the roll forming and tubemaking industries. We received a total of 270 usable responses for a response rate of 12.6%. An industry total of 1800 plants was assumed for the purpose of estimating industry totals.

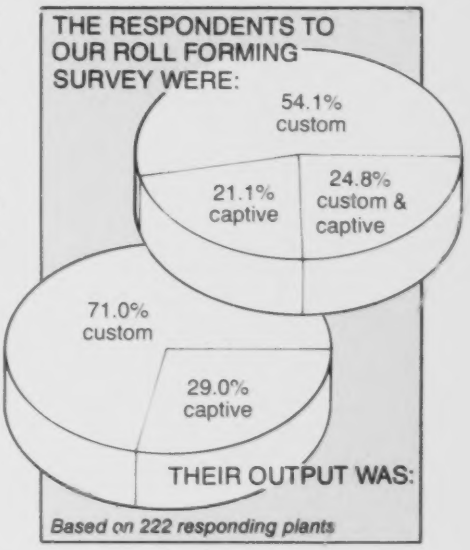
The roll forming industry is largely custom, with over 70% of our respondents' output for resale. The tubemaking industry, however, is only slightly more custom than captive; indeed, there were actually more purely captive than purely custom plants in our survey. Most of the plants in our survey had 25 or fewer employees involved in the roll forming or tubemaking operation.

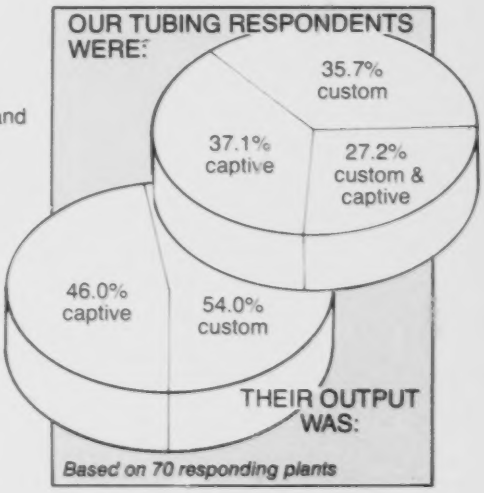
The most widely roll formed metals are carbon steel, galvanized steel and prepainted strip. Our respondents ex-

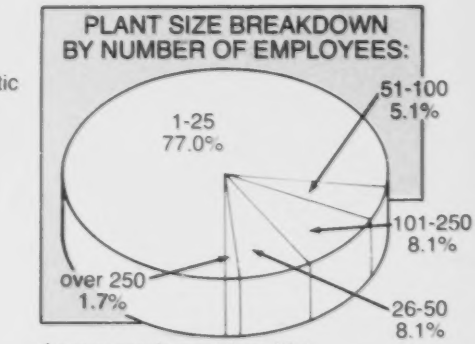



*Based on computer analysis of PRECISION METAL circulation*



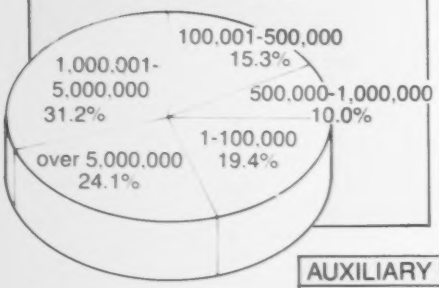




*Average employees/plant: 33.1*
*Based on 235 responding plants*

| SHIPMENTS (1980) | | | | | SHIPMENT TRENDS *Based on 171 responding plants* | | | |
|---|---|---|---|---|---|---|---|---|
| Metal or alloy | Number of plants | Respondents shipped (lb) | Average/ plant (lb) | Projected ind. total (lb) | 1981 change (%) | 1982 expectation (%) Increase | Decrease | About the same |
| Aluminum | 49 | 27,468,038 | 160,631 | 290,000,000 | +10.7 | 50.0 | 5.0 | 45.0 |
| Brass | 9 | 46,419 | 271 | 490,000 | + 4.8 | 38.5 | 7.7 | 53.8 |
| Copper | 11 | 2,327,012 | 13,608 | 24,000,000 | +31.7 | 66.7 | 0.0 | 33.3 |
| Laminated strip | 5 | 3,855,000 | 22,544 | 41,000,000 | + 1.2 | 11.1 | 11.1 | 77.8 |
| Magnesium | 1 | 10,000 | 58 | 110,000 | 0.0 | 0.0 | 25.0 | 75.0 |
| Prefinished strip | 4 | 978,000 | 5719 | 10,000,000 | +10.7 | 50.0 | 10.0 | 40.0 |
| Prepainted strip | 31 | 181,493,112 | 1,061,363 | 1,900,000,000 | + 7.7 | 45.9 | 8.2 | 45.9 |
| Preplated strip | 11 | 27,696,000 | 161,965 | 290,000,000 | + 6.0 | 38.9 | 16.7 | 44.4 |
| Steel, carbon | 90 | 586,208,113 | 3,428,118 | 6,200,000,000 | +12.0 | 52.3 | 3.7 | 44.0 |
| Steel, galvanized | 64 | 265,079,674 | 1,550,174 | 2,800,000,000 | − 2.8 | 56.5 | 2.9 | 40.6 |
| Steel, high-strength low-alloy | 20 | 58,012,800 | 339,256 | 610,000,000 | −13.7 | 53.8 | 7.7 | 38.5 |
| Steel, stainless | 45 | 30,000,878 | 175,444 | 320,000,000 | + 0.6 | 45.5 | 1.8 | 52.7 |
| Vinyl clad strip | 7 | 3,530,000 | 20,643 | 37,000,000 | − 3.0 | 54.5 | 0.0 | 45.5 |
| Zinc | 1 | 560,000 | 3275 | 5,900,000 | −10.7 | 0.0 | 100.0 | 0.0 |
| Other | 11 | 9,420,223 | 55,089 | 99,000,000 | | | | |
| Total | 171 | 1,196,685,279 | 6,998,159 | 13,000,000,000 | | | | |

PLANT SIZE BREAKDOWN BY SHIPMENTS




*Based on 171 responding plants*

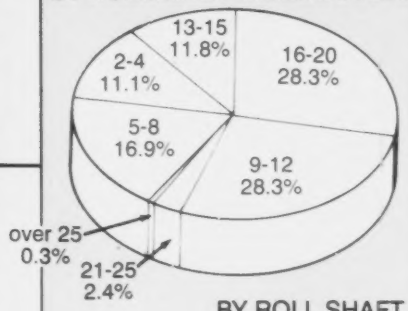
| ROLL FORMERS & TUBE MILLS | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of machines | Average/ plant | Projected ind. total | Number of plants | Number of machines |
| Roll formers | 225 | 1601 | 6.3 | 11,000 | 58 | 116 |
| Tube mills | 53 | 237 | 0.9 | 1700 | 16 | 25 |

*Based on 256 responding plants*

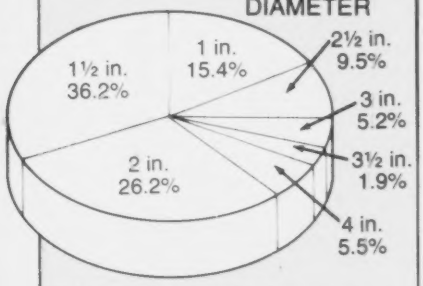
| AUXILIARY EQUIPMENT | Now installed | | | | Plan to buy by end 1982 | |
|---|---|---|---|---|---|---|
| | Number of plants | Number of machines | Average/ plant | Projected ind. total | Number of plants | Number of machines |
| Coil cars | 44 | 280 | 1.4 | 2500 | 7 | 11 |
| Coil coaters | 16 | 48 | 0.2 | 420 | 3 | 3 |
| Coil lifters | 82 | 253 | 1.2 | 2200 | 10 | 13 |
| Coil tippers | 28 | 54 | 0.3 | 470 | 5 | 6 |
| Conveyors, pre-cut stock | 41 | 173 | 0.8 | 1500 | 7 | 15 |
| Cut-off equipment | 157 | 1148 | 5.6 | 10,000 | 22 | 44 |
| Edge finishers | 42 | 131 | 0.6 | 1200 | 3 | 4 |
| Embossing machines | 22 | 53 | 0.3 | 470 | 2 | 2 |
| Forming presses | 80 | 1224 | 6.0 | 11,000 | 7 | 11 |
| Jib cranes | 92 | 523 | 2.6 | 4600 | 11 | 29 |
| Lubricators | 60 | 528 | 2.6 | 4600 | 15 | 44 |
| Power shears | 132 | 421 | 2.1 | 3700 | 8 | 9 |
| Press brakes | 27 | 576 | 2.8 | 5100 | 10 | 13 |
| Punching/notching presses | 147 | 1385 | 6.8 | 12,000 | 15 | 75 |
| Reels, uncoilers | 157 | 1312 | 6.7 | 12,000 | 19 | 47 |
| Slitters | 84 | 177 | 0.9 | 1600 | 5 | 8 |
| Stackers, pre-cut stock | 26 | 94 | 0.5 | 830 | 1 | 1 |
| Stock straighteners | 84 | 388 | 1.9 | 3400 | 12 | 12 |
| Strip accumulators | 28 | 91 | 0.4 | 800 | 4 | 9 |
| Strip polishers | 7 | 12 | 0.1 | 110 | 1 | 1 |
| Uncoilers | 58 | 339 | 1.7 | 3000 | 8 | 15 |
| Welders, coil end | 80 | 271 | 1.3 | 2400 | 11 | 18 |
| Welders, seam | 54 | 172 | 0.8 | 1500 | 9 | 15 |
| Wing formers | 11 | 23 | 0.1 | 200 | 0 | 0 |

*Based on 205 responding plants*

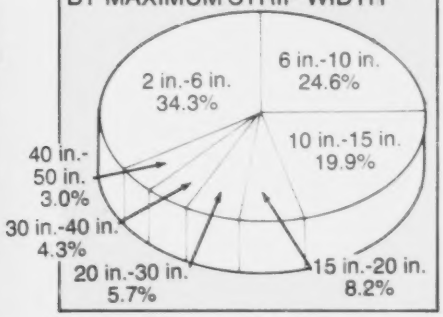
## ROLL FORMING MACHINE BREAKDOWN BY NUMBER OF ROLL STANDS




## BY ROLL SHAFT DIAMETER



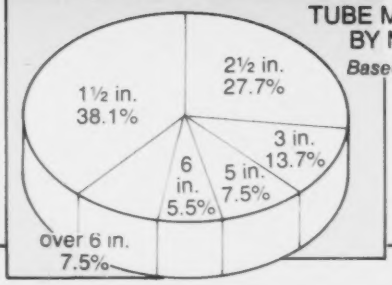

## BY MAXIMUM STRIP WIDTH




*Based on 232 responding plants*

## TUBE MILL BREAKDOWN BY MAXIMUM O.D.

*Based on 57 responding plants*




| EXPENDABLE SUPPLIES | | | | |
|---|---|---|---|---|
| Type | Number of plants | Respondents used | Average/ plant | Projected ind. total |
| Coil coating materials | 19 | 228,845 gal | 1861 gal | 3,300,000 gal |
| Lubricants | 117 | 747,470 gal | 6077 gal | 11,000,000 gal |

*Based on 123 responding plants*

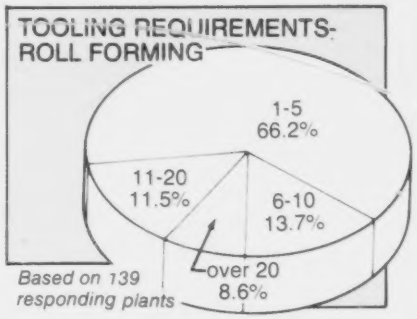
| ROLL SETS (NEW IN 1980) | | | | |
|---|---|---|---|---|
| Type | Number of plants | Respondents used | Average/ plant | Projected ind. total |
| Roll forming | 139 | 1863 | 9.9 | 18,000 |
| Tubemaking | 34 | 275 | 1.5 | 2600 |
| Reground rolls | 149 | 2479 | 13.1 | 24,000 |

*Based on 189 responding plants*

## DO PLANTS MAKE OWN ROLLS?

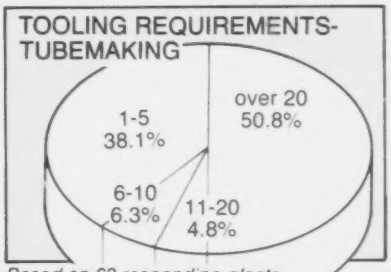
*Based on 252 responding plants*

## TOOLING REQUIREMENTS-ROLL FORMING



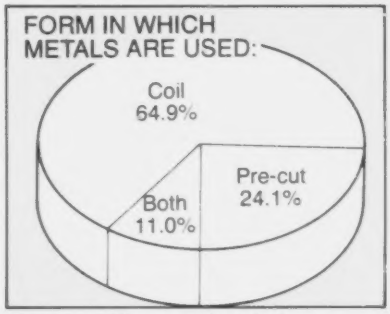

*Based on 139 responding plants*

## TOOLING REQUIREMENTS-TUBEMAKING



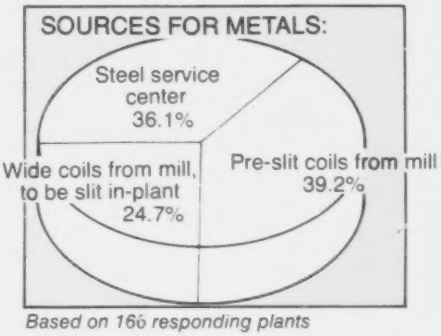

*Based on 63 responding plants*
*Numbers in wedges on pie chart indicate numbe, of dies per plant*

## FORM IN WHICH METALS ARE USED:




*Based on 259 responding plants*

## SOURCES FOR METALS:




*Based on 166 responding plants*

| END-USE INDUSTRIES | |
|---|---|
| Sporting goods | 1.4% |
| Transportation | 18.2% |
| Construction/building products | 40.4% |
| Furniture & office equipment | 6.1% |
| Appliances | 5.1% |
| Aerospace | 4.9% |
| Agriculture | 2.4% |
| Electrical | 1.5% |
| Food products | 3.3% |
| Housewares | 2.5% |
| Chemicals | 1.7% |
| Process vessels | 1.7% |
| Storage racks | 1.7% |
| Other | 9.1% |

*Based on 243 responding plants*

pect increases in a majority of metals for 1981. Roll forming plants tend to ship a lot of metal—more than half of our respondents shipped over 1,000,000 pounds of roll formed parts in 1980.

The greatest number of roll orming machines fall into the 9-12 and 16-20 roll stand categories. Most machines have roll stand diameters less than $2\frac{1}{2}$ in. and can handle maximum strip widths of 10 in. or less. Most tube mills have maximum O.D.'s of $1\frac{1}{2}$ or $2\frac{1}{2}$ in.

The majority of rolls are purchased from outside roll makers. Our respondents had more rolls reground in 1980 than were bought new. Tubemaking plants tended to use more new rolls than roll forming plants.

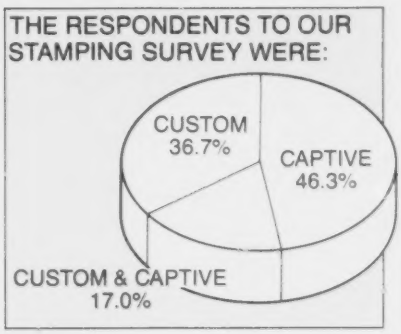
Most plants use strip in coil form, rather than pre-cut. The majority of plants buy from steel service centers or buy pre-slit coils from steel mills.

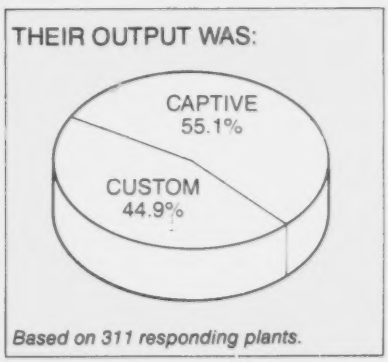
The construction/building products category is easily the largest end-use market, followed by transportation. The remainder of shipments are split among a wide variety of markets.

# STATE OF THE STAMPING INDUSTRY

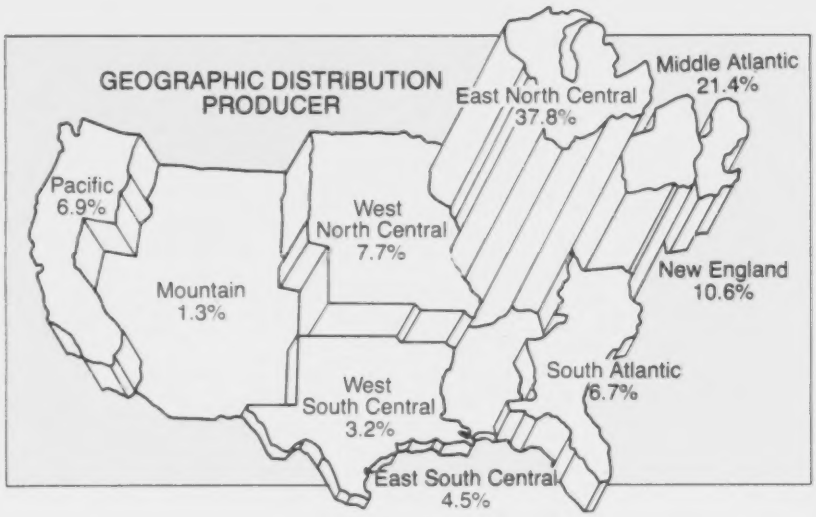
Questionnaires were sent to 2395 management and production executives in the stamping industry. A total of 314 usable responses was obtained, for a response rate of 13.1%. An industry total of 10,000 plants was assumed, based on data from the *1977 Census of Manufacturers*.

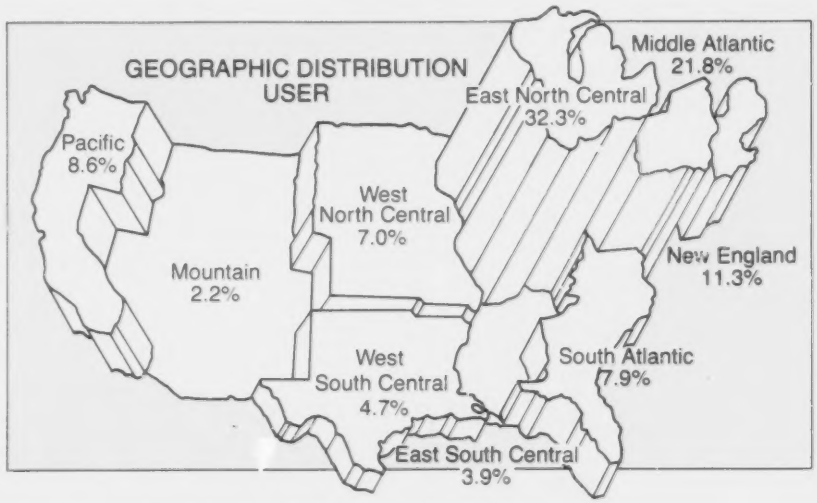
Unlike most of the other precision metal industries, the stamping industry is primarily captive. Although our respondents' output was only 55% cap-




*Based on 311 responding plants.*




*Based on computer analysis of PRECISION METAL circulation*

## TYPES OF STAMPING PERFORMED BY RESPONDENTS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Percentage of respondents** | 36.0 | 22.3 | 60.8 | 13.7 | 51.0 | 74.5 | 64.0 |
| **Type** | Deep drawing | Fine blanking | Long run | Multi-slide | Press braking | Progressive die | Short run |
| **Projected ind. total** | 3600 | 2230 | 6080 | 1370 | 5100 | 7450 | 6400 |

***Based on 314 responding plants.***

| SHIPMENTS (1980) | | | |
|---|---|---|---|
| **Metal or alloy** | **Number of respondents** | **Respondents shipped (lb)** | **Projected ind. total (lb)** |
| Aluminum | 84 | 48,446,650 | 2,400,000,000 |
| Beryllium copper | 20 | 103,530 | 5,100,000 |
| Brass | 46 | 1,003,320 | 49,000,000 |
| Bronze | 10 | 113,175 | 5,500,000 |
| Copper | 28 | 2,007,350 | 98,000,000 |
| Nickel | 7 | 45,900 | 2,200,000 |
| Alloy steel | 47 | 22,379,860 | 1,100,000,000 |
| Carbon steel | 130 | 426,218,520 | 21,000,000,000 |
| Galvanized steel | 47 | 74,765,745 | 3,700,000,000 |
| Polished steel | 8 | 996,000 | 49,000,000 |
| Pre-finished steel | 21 | 6,443,500 | 320,000,000 |
| Stainless steel | 82 | 20,332,010 | 1,000,000,000 |
| Terne plate | 10 | 2,317,000 | 110,000,000 |
| Tin plate | 11 | 6,561,000 | 320,000,000 |
| Others | 23 | 47,802,200 | 2,300,000,000 |
| **Total** | **197** | **619,535,760** | **30,000,000,000** |

| SHIPMENT TRENDS | | | | |
|---|---|---|---|---|
| | | 1982 Expectation (%) | | |
| Metal or alloy | 1981 Change (%) | Increase | Decrease | About the same |
| Aluminum | +19.4 | 40.9 | 11.4 | 47.6 |
| Beryllium copper | +17.2 | 31.8 | 8.4 | 59.8 |
| Brass | +55.6 | 43.9 | 6.2 | 49.9 |
| Bronze | − 5.3 | 25.0 | 2.8 | 72.2 |
| Copper | +11.4 | 41.0 | 5.0 | 54.0 |
| Nickel | + 7.9 | 20.3 | 24.1 | 55.6 |
| Alloy steel | + 9.1 | 52.3 | 7.5 | 40.2 |
| Carbon steel | +20.9 | 52.8 | 7.2 | 40.1 |
| Galvanized steel | +24.0 | 49.9 | 8.7 | 41.4 |
| Polished steel | +21.3 | 73.3 | 6.7 | 20.0 |
| Pre-finished steel | + 1.4 | 38.1 | 4.8 | 57.1 |
| Stainless steel | + 9.8 | 40.1 | 11.2 | 48.7 |
| Terne plate | +10.3 | 62.2 | 14.4 | 23.4 |
| Tin plate | +10.3 | 59.4 | 9.1 | 31.5 |
| Other | +11.8 | 32.4 | 5.3 | 62.3 |

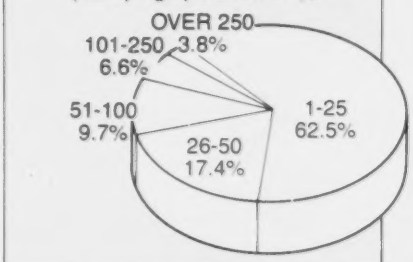
*The 1981 change column represents respondents' expected change in shipment poundage from 1980, expressed in percent.*

*The 1982 expectation gives the percentage of respondents expecting 1982 shipments to increase, decrease or stay about the same as 1980.*

*Based on 197 responding plants*

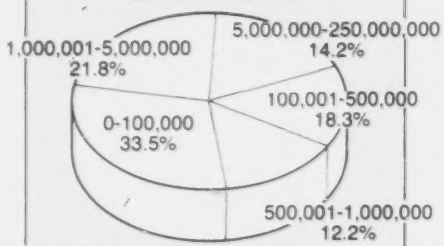
| WHERE METALS ARE PURCHASED: | | |
|---|---|---|
| | Number of plants | Percentage of reported poundage |
| Steel service center | 96 | 32.3 |
| Pre-slit coils from mill | 70 | 11.0 |
| Wide coils to be slit in-plant | 24 | 56.7 |

PLANT SIZE BREAKDOWN BY NUMBER OF EMPLOYEES
(stamping operation only)




*Average employees per stamping operation: 39.4*
*Based on 288 responding plants.*

PLANT SIZE BREAKDOWN BY SHIPMENTS




*Based on 197 responding plants*

FORM IN WHICH METALS ARE USED

| | |
|---|---|
| Pre-cut: | 56.9% |
| Coil: | 80.3% |

responding plants

*Based on 290 responding plants*

## STAMPING PRESSES INSTALLED

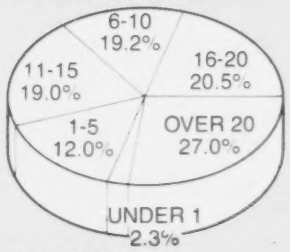
| Size (tons) | Mechanical | | Hydraulic | | Total | |
|---|---|---|---|---|---|---|
| | Respondents have | Projected ind. total | Respondents have | Projected ind. total | Respondents have | Projected ind. total |
| 1-10 | 410 | 15,000 | 275 | 10,000 | 685 | 26,000 |
| 11-50 | 1790 | 68,000 | 166 | 6,300 | 1956 | 74,000 |
| 51-100 | 1292 | 49,000 | 95 | 3,600 | 1387 | 52,000 |
| 101-500 | 938 | 35,000 | 140 | 5,300 | 1078 | 41,000 |
| over 500 | 103 | 3,900 | 18 | 680 | 121 | 4,600 |
| **Total** | 4533 | 171,000 | 694 | 26,000 | 5227 | 197,000 |

*Based on 265 responding plants*

## STAMPING PRESS BUYING PLANS FOR 1981

| Size (tons) | Mechanical | | Hydraulic | | Total |
|---|---|---|---|---|---|
| | Number of plants | Number of presses | Number of plants | Number of presses | Number of presses |
| 1-10 | 2 | 4 | 1 | 2 | 6 |
| 11-50 | 14 | 21 | 3 | 5 | 26 |
| 51-100 | 14 | 39 | 2 | 6 | 45 |
| 101-500 | 17 | 28 | 1 | 1 | 29 |
| over 500 | 1 | 1 | 0 | 0 | 1 |
| No capacity | 1 | 30 | 0 | 0 | 30 |
| **Total** | 40 | 123 | 7 | 14 | 137 |

## STAMPING PRESS BREAKDOWN BY AGE




*Age figures are in years*

## STAMPING PRESS BUYING PLANS FOR 1982

| Size (tons) | Mechanical | | Hydraulic | | Total |
|---|---|---|---|---|---|
| | Number of plants | Number of presses | Number of plants | Number of presses | Number of presses |
| 1-10 | 1 | 5 | 1 | 2 | 7 |
| 11-50 | 15 | 17 | 2 | 4 | 21 |
| 51-100 | 19 | 45 | 2 | 5 | 50 |
| 101-500 | 24 | 43 | 1 | 1 | 44 |
| over 500 | 3 | 5 | 2 | 2 | 7 |
| No capacity | 1 | 50 | 0 | 0 | 50 |
| **Total** | 46 | 165 | 9 | 14 | 179 |

## AUXILIARY EQUIPMENT INSTALLED

| Type | Number of plants | Number of units | Avg./ plant | Projected ind. total |
|---|---|---|---|---|
| Acoustic enclosures | 46 | 185 | 0.7 | 6,800 |
| Bending rolls | 69 | 181 | 0.7 | 6,600 |
| Coil cars | 35 | 138 | 0.5 | 5,100 |
| Coil coaters | 22 | 123 | 0.5 | ***** |
| Coil cradles | 122 | 3204 | 11.7 | 117,000 |
| Coil end joiners | 25 | 69 | 0.3 | ***** |
| Coil reels | 168 | 2463 | 9.0 | 90,000 |
| Coil slitters | 39 | 86 | 0.3 | ***** |
| Coil tippers | 15 | 53 | 0.2 | ***** |
| Conveyors, pre-cut stock | 32 | 140 | 0.5 | 5,100 |
| Cut-off equipment | 102 | 313 | 1.1 | 11,000 |
| Die cushions | 109 | 861 | 3.2 | 32,000 |
| Die cylinders (hydraulic) | 40 | 205 | 0.8 | 7,500 |
| Die cylinders (nitrogen) | 30 | 188 | 0.7 | 6,900 |
| Lubricators | 159 | 1450 | 5.3 | 53,000 |
| Nibblers | 84 | 174 | 0.6 | ***** |
| Notchers | 64 | 127 | 0.5 | 4,700 |
| Press brakes | 152 | 759 | 2.8 | 28,000 |
| Press controls | 98 | 1711 | 6.3 | 63,000 |
| Press feeds | 177 | 1811 | 6.6 | 66,000 |
| Scrap choppers | 95 | 514 | 1.9 | 19,000 |
| Scrap conveyors | 63 | 711 | 2.6 | 26,000 |
| Spinning machinery | 23 | 80 | 0.3 | ***** |
| Stackers, pre-cut stock | 23 | 129 | 0.5 | 4,700 |
| Stock straighteners | 134 | 790 | 2.9 | 29,000 |
| Trimming machines | 30 | 127 | 0.5 | 4,700 |

*Based on 273 responding plants*

*****indicates that the data were considered insufficient for projection.*

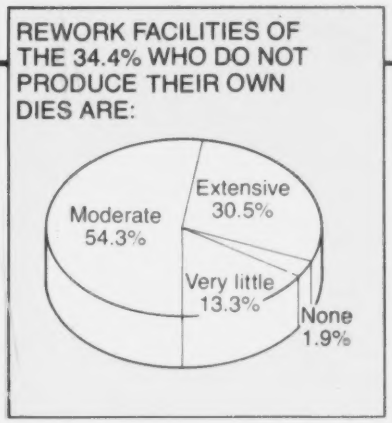
## AUXILIARY EQUIPMENT BUYING PLANS

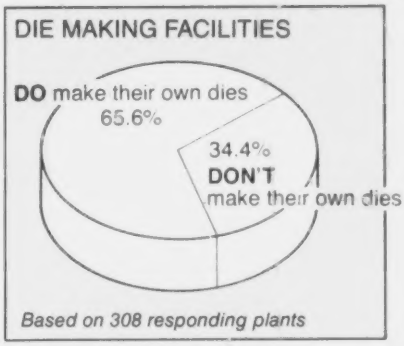
| Type of equipment | 1981 | | 1982 | |
|---|---|---|---|---|
| | Number of plants | Number of units | Number of plants | Number of units |
| Acoustic enclosures | 8 | 39 | 7 | 14 |
| Bending rolls | 3 | 3 | 4 | 6 |
| Coil cars | 3 | 4 | 4 | 5 |
| Coil coaters | 1 | 2 | - | - |
| Coil cradles | 7 | 12 | 10 | 14 |
| Coil end joiners | 4 | 5 | 4 | 5 |
| Coil reels | 19 | 45 | 14 | 45 |
| Coil slitters | 4 | 5 | 3 | 3 |
| Coil tippers | 1 | 2 | 1 | 1 |
| Conveyors (pre-cut stock) | 4 | 7 | 4 | 7 |
| Cut-off equipment | 7 | 8 | 9 | 10 |
| Die cushions | 7 | 9 | 9 | 13 |
| Die cylinders (hydraulic) | - | - | 2 | 4 |
| Die cylinders (nitrogen) | 6 | 14 | 2 | 3 |
| Lubricators | 22 | 65 | 16 | 36 |
| Nibblers | - | - | 3 | 4 |
| Notchers | 1 | 1 | 2 | 2 |
| Press brakes | 11 | 17 | 12 | 16 |
| Press controls | 11 | 57 | 11 | 53 |
| Press feeds | 25 | 58 | 22 | 45 |
| Scrap choppers | 10 | 17 | 6 | 8 |
| Scrap conveyors | 14 | 33 | 13 | 36 |
| Spinning machinery | 1 | 1 | 2 | 3 |
| Stackers (pre-cut stock) | 3 | 3 | 3 | 3 |
| Stock straighteners | 19 | 37 | 18 | 35 |
| Trimming machinery | 1 | 1 | 2 | 4 |

*Based on 273 responding plants*

## NEW DIES IN 1980

19,402 new die sets were used by respondents in 1980
Average/plant: 73.8
Projected industry total: 738,000 die sets
Based on 263 responding plants

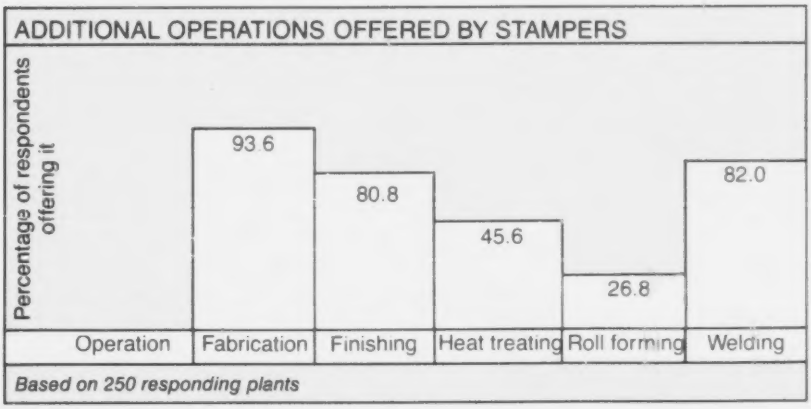


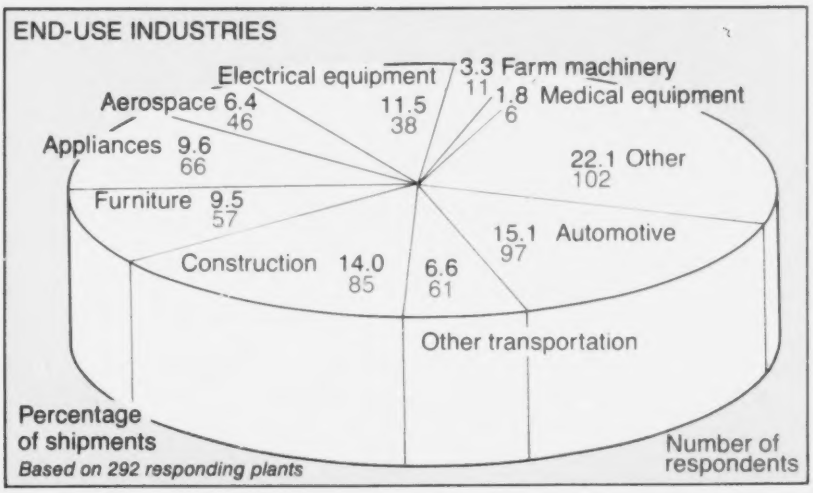




## EXPENDABLE SUPPLIES

**Die lubricants:** 113 respondents used 63,075 gallons in 1980
Average/plant: 558.2 gal.
Projected industry total: 2,000,000 gal.

**Hydraulic fluid:** 56 respondents used 50,350 gallons in 1980
Average/plant: 899 gal.
Projected industry total: 4,000,000 gal.




tive, over 80% of the stamping facilities in the United States are captive according to the 1977 census.

There are several different types of stamping. More than half our respondents perform long run, short run and progressive die stamping, as well as press braking. Most stamping operations have 25 or fewer employees, which is not surprising considering that most stamping operations are relatively small, producing parts to be used in-plant.

The great majority of stamping presses are mechanical; still, the hydraulic press market in stamping is quite large due to the size of the industry. Nearly half the installed stamping presses in the United States are over 15 years old. Buying plans for 1981 and 1982 fall into the same general pattern as installed presses.

The stamping industry also uses a wide variety of auxiliary equipment, of which coil handling equipment, press feeds and lubricators are the most widely used. Buying plans fall into the same general pattern as installed equipment.

Nearly two-thirds of respondents make at least some of their own dies. Virtually all of the plants who do not make their own dies have some rework facilities.

# STATE OF THE INDUSTRY OUTLOOK

By MICHAEL KEATING, senior market analyst
*Penton/IPC Marketing Research & Economic Analysis*

What do the precision metal industries have to look forward to in 1982? Based on the experts we talked to, there's a lot of interest in interest rates. Quite a few of the experts feel that a drop in interest rates is crucial to a rebound in durable goods sales. Here's a brief look at some key market areas:

## Aerospace

According to Gerald McAllister, publications director for the Aerospace Industries Assn., 1982 will be similar to 1981 in that fighter aircraft of proven design such as the F-15 or F-16 will be rolling out of the production plants at a steady pace. According to the latest Standard & Poor's analysis, actual defense outlays should equal $184.8 billion in fiscal year 1982, a 16.5% increase in current dollar spending over fiscal year 1981.

McAllister points out that "there will be some slowdown in commercial aircraft deliveries...some airlines will delay delivery of their ordered Boeing 757 and 767's...but the forgings industry is stacked up enough that any commercial airline holdups won't affect it much." Standard & Poor's predicts 25-30 deliveries of Boeing 727's in 1982.

Dick Scofield, director of marketing at the Forging Industry Assn., expects the aerospace market to get stronger in 1982—and with as many as 30,000 forgings on each B-1 bomber, this market isn't one to sneeze at.

FEDERAL RESERVE BANK DURABLES

| ITEM | YEARS & QUANTITIES 1975/7 | 1980 | 1981 | 1982 | 1985 | 1990 | 1995 | ANNUAL GROWTH 1990/79 |
|---|---|---|---|---|---|---|---|---|
| **DURABLE MANUFACTURES** | **120.6** | **136.7** | **144** | **153** | **182** | **216** | **248** | **3.6%** |
| ORDNANCE, PRIVATE & GOVT | 74.3 | 77.9 | 80 | 82 | 88 | 96 | 109 | 2.2% |
| FURNITURE & FIXTURES | 133.3 | 150.0 | 155 | 164 | 190 | 223 | 256 | 3.0% |
| Household Furniture | 137.1 | 144.4 | 151 | 160 | 188 | 217 | 246 | 2.7% |
| Fixtures & Office Furniture | 131.5 | 170.3 | 172 | 181 | 206 | 250 | 295 | 3.6% |
| PRIMARY METALS | 105.7 | 101.6 | 114 | 121 | 140 | 161 | 183 | 2.6% |
| Basic Iron & Steel | 96.9 | 86.1 | 98 | 102 | 110 | 120 | 131 | 1.2% |
| Steel Mill Products | 104.6 | 99.3 | 116 | 120 | 127 | 139 | 155 | 1.3% |
| Iron & Steel Foundries | 101.5 | 82.8 | 96 | 103 | 122 | 134 | 148 | 2.0% |
| Nonferrous Metals | 122.4 | 133.8 | 140 | 152 | 188 | 230 | 270 | 4.3% |
| Nonferrous Products | 115.9 | 120.2 | 130 | 143 | 184 | 225 | 265 | 4.3% |
| FABRICATED METAL PRODUCTS | 121.6 | 135.1 | 141 | 150 | 178 | 201 | 221 | 2.8% |
| Metal Cans | 134.8 | 128.0 | 133 | 143 | 175 | 205 | 231 | 3.6% |
| Hardware, Plumbing, Struc. Metal | 128.6 | 144.1 | 148 | 156 | 183 | 200 | 212 | 2.3% |
| Other Fabricated Metal Products | 113.4 | 127.6 | 136 | 145 | 173 | 202 | 228 | 3.2% |
| NONELECTRICAL MACHINERY | 134.4 | 163.1 | 173 | 182 | 213 | 258 | 300 | 4.2% |
| Engine & Farm Equipment | 153.7 | 154.0 | 155 | 168 | 222 | 267 | 323 | 4.0% |
| Construction & Allied Equip. | 130.6 | 151.9 | 157 | 164 | 185 | 210 | 225 | 2.8% |
| Metalworking Machinery | 99.5 | 126.8 | 132 | 139 | 164 | 196 | 230 | 4.0% |
| Special & General Industrial Mach | 109.8 | 126.0 | 131 | 139 | 166 | 201 | 225 | 4.1% |
| Office, Service & Misc Equip | 171.3 | 228.9 | 252 | 262 | 296 | 368 | 440 | 4.9% |
| ELECTRICAL MACHINERY | 132.2 | 172.7 | 179 | 192 | 236 | 295 | 359 | 4.9% |
| Major Electrical Equip & Parts | 114.6 | 142.6 | 147 | 157 | 190 | 240 | 299 | 4.4% |
| Household Appliances | 131.2 | 136.1 | 146 | 161 | 220 | 260 | 300 | 5.1% |
| Electronic Components | 190.0 | 304.6 | 312 | 342 | 436 | 566 | 706 | 6.1% |
| Radio & TV Sets | 92.6 | 92.0 | 103 | 107 | 120 | 136 | 151 | 3.2% |
| Communications Equipment | 111.4 | 155.0 | 159 | 164 | 178 | 212 | 252 | 3.3% |
| Misc. Electrical Supplies | 164.6 | 167.3 | 181 | 198 | 268 | 339 | 415 | 5.7% |
| TRANSPORTATION EQUIPMENT | 110.3 | 116.9 | 122 | 131 | 160 | 183 | 204 | 2.8% |
| Motor Vehicles & Parts | 138.1 | 118.8 | 130 | 142 | 186 | 213 | 237 | 2.6% |
| Aircraft & Parts | 71.6 | 106.1 | 107 | 110 | 120 | 130 | 140 | 2.4% |
| Other Transport Equipment | 129.0 | 147.6 | 143 | 158 | 193 | 246 | 294 | 4.1% |
| INSTRUMENTS | 145.0 | 171.1 | 174 | 189 | 237 | 299 | 361 | 5.0% |
| Equipment Instruments & Parts | 144.5 | 185.8 | 190 | 204 | 246 | 314 | 376 | 4.9% |
| Consumer Instrument Products | 145.5 | 155.9 | 157 | 173 | 228 | 284 | 345 | 5.1% |

*Source: Federal Reserve Bank. Forecasts by Predicasts.*
*Shipments are indexed to 1967=100.*

## Construction industry

Phillip Kidd, director of economic research at F.W. Dodge, forecasts "a modest recovery in the first quarter of 1982 followed by continued improvement in the second half." A drop in interest rates should propel housing starts to a 21% improvement over 1981, when 1.15 million housing units were constructed, says Kidd. Standard & Poor's predicts that revised zoning laws in California, Michigan and other states should spur shipments of manufactured housing (mobile homes) to 300,000—350,000 units annually between 1982 and 1984. As recently as 1980 annual shipments were only 221,000 units.

Kidd of F.W. Dodge feels there won't be any improvement in commercial and industrial construction in 1982. While retail and manufacturing industry construction will be up in 1982, there won't be the boomlet in office high-rises that occurred in 1981.

## Household appliances

Production of ranges, refrigerators, dishwashers and other appliances should rise a bit in 1982, according to William Comstock, vice president-public affairs at the Assn. of Home Appliance Manufacturers. His group forecasts 33.8 million units shipped in 1982, up from 31.6 million in 1981. New family formations, lower interest rates, and advanced age of many machines in use are all reasons for Comstock's optimism in 1982. Microwave ovens will continue to be a star performer; factory shipments will be 10% above the 4.16 million units shipped in 1981.

## Metalforming equipment & tooling

According to Wayne Eason, manager of communications at the National Tooling and Machining Assn., his group's latest forecasts project a 10% increase in tool and die production for 1982 over 1981. Over the long haul, his group holds the most optimism for energy, defense and some electronics markets.

Robert Hunsberger, U.S. Dept. of Commerce analyst who follows the metalforming equipment industries, is banking on reduced interest rates to fuel a 6.8% constant-dollar increase in metalforming equipment sales for 1982 over 1981. Some areas where he looks for improved sales are: forging and OBI presses, punches and shears, and die casting equipment. Hunsberger predicts appliance manufacturers and others will take advantage of the new tax cuts and install faster presses and more accurate die casting machines to compete with foreign firms. He advises die casting equipment producers that they will find their best prospects in the next few months in aerospace, oil drilling and shipbuilding industries.

## Motor vehicles

Standard & Poor's latest auto industry analysis forecasts a 20% rise in domestic vehicle production, assuming that there is no long strike when the UAW's contracts with the Big Three expire in September, 1982. Buyers who postponed purchases in 1980 and 1981 will now come forward, reports the analysis. Passenger car sales (domestic and foreign) could be up 15% over 1981 when 9.2 million units are expected to be sold. U.S. manufacturers should gain more in 1982 sales than foreign firms.

## Off-road equipment

Farm equipment manufacturers may enjoy a 1982 sales rebound, predicts Harold Halter of the Farm Equipment Manufacturers Assn. If there is a turnaround it won't start until 1982, and it will hinge on a drop in interest rates for farmers. Two other factors that could lead to improved farm equipment sales in 1982 are: big increases in grain exports to Russia, and farmers' deferred equipment purchases that date back to the spring of 1980.

Another expert who sees a connection between lower interest rates and improved 1982 off-road sales is John Mackin, vice president of Morgan Stanley and Co., a New York investment firm. Mackin predicts that if there is an off-road sales recovery, it won't be until the second quarter. One bright spot in 1981 sales, according to Mackin, has been the lifting crane business due to increased high-rise construction.

**Predicasts peers into casting's future**

Predicasts, Inc. (which prepared the forecasts in the table on the facing page) has prepared a study of the future of the casting industry. Although the study covers all types of casting, there is information of interest to the precision metal industries.

Aluminum die casting shipments are projected to rise from 462,900 tons in 1980 to 1,500,000 tons in 1995, for an annual growth rate of 8.2%. This growth is expected to come from increased penetration of aluminum die castings into the automotive market. Value of aluminum die casting shipments in 1995 is forecast to be over $15 billion. Aside from automobiles, the major growth areas for aluminum castings are expected to be other transportation markets, household appliances and office machinery.

Zinc casting shipments are expected to decrease from 345,900 tons in 1980 to 325,000 tons in 1995. This decline is accounted for enitrely in the automotive market, where shipments are predicted to fall from 156,100 tons to 90,000 tons in the 1980-1995 period, partly due to thin wall castings replacing heavier castings. Zinc die casting usage in builders' hardware and machinery is expected to increase.

Magnesium casting shipments are expected to soar from 17,400 tons in 1980 to 95,000 tons in 1995. The largest portion of this increase is expected to come from automotive shipments, which are predicted to jump from 1000 tons in 1980 to 50,000 tons in 1995. Other markets for magnesium die castings are expected to increase, also.

The complete report may be obtained from Predicasts, Inc., 200 University Circle Research Center, 11001 Cedar Ave., Cleveland, Ohio 44106.

## Office equipment

John Dykeman, executive editor of PRECISION METAL's sister publication, MODERN OFFICE PROCEDURES, lists personal computers, word processing systems, intelligent electronic typewriters and all types of data terminals as areas of growing sales in 1982.

Colorado Sintered Metals, a custom P/M parts producer, is enjoying success in the data processing equipment area. According to Tom Van Camp, vice president of sales, "The computer industry is moving; mechanical parts used in computer tape and disk drive units is an area of steady sales." Van Camp is optimistic that "from the second quarter of 1982 there will be some improvement in overall sales."